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PANASONIC CT-13R32E SERVICE MANUAL

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Service Manual

Color Television

Main Manual
(NA7D)

CT-13R32

CT-13R52

Panasonic

Models	Chassis
CT-13R32E	**DP358**
CT-13R32CE	**DP358**
CT-13R42E	**DP358**
CT-13R42CE	**DP358**
CT-13R52DE	**EP358**

Note: *CT-13R42E/CE are identical to CT-13R32E/CE, respectively, except for cabinet color. (CT-13R42E/CE have white cabinets).*

This Service manual is issued as a service guide for the models of the **NA7D** family listed above. Included are schematics, alignment procedures, disassembly procedures, and a parts list.

"**WARNING!** This Service Manual is designed for experienced repair technicians only and is not designed for use by the general public. It does not contain warnings or cautions to advise non-technical individuals of potential dangers in attempting to service a product. **Products powered by electricity should be serviced or repaired only by experienced professional technicians.** Any attempt to service or repair the product or products dealt with in this Service Manual by anyone else could result in serious injury or death."

The service technician is required to read and follow the "**Safety Precautions**" and "**Important Safety Notice**" in this Manual.

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Important Safety Notice

Special components are used in this television set which are important for safety. These parts are identified on the schematic diagram by the symbol ⚠ and printed in **BOLD TYPE** on the replacement part list. It is essential that these critical parts are replaced with the manufacturer's specified replacement part to prevent X-ray radiation, shock, fire or other hazards. Do not modify the original design without the manufacturer's permission.

Safety Precautions

General Guidelines

An **Isolation Transformer** should always be used during the servicing of a Receiver whose chassis is not isolated from AC power line. Use a transformer of adequate power rating as this protects the technician from accidents resulting in personal injury from electrical shocks. It will also protect the Receiver from being damaged by accidental shorting that may occur during servicing.

When servicing, observe the original lead dress, especially in the high voltage circuit. Replace all damaged parts (also parts that show signs of overheating.)

Always Replace Protective Devices, such as fishpaper, isolation resistors and capacitors, and shields after servicing the Receiver. Use only manufacturer's recommended rating for fuses, circuits breakers, etc.

High potentials are present when this Receiver is operating. Operation of the Receiver without the rear cover introduces danger for electrical shock. Servicing should not be performed by anyone who is not thoroughly familiar with the necessary precautions when servicing high-voltage equipment.

Extreme care should be practiced when **Handling the Picture Tube**. Rough handling may cause it to implode due to atmospheric pressure. (14.7 lbs per sq. in.). Do not nick or scratch the glass or subject it to any undue pressure. When handling, use safety goggles and heavy gloves for protection. **Discharge the picture tube** by shorting the anode to chassis ground (not to the cabinet or to other mounting hardware). When discharging connect cold ground (i.e. dag ground lead) to the anode with a well insulated wire or use a grounding probe.

Avoid prolonged exposure at close range to unshielded areas of the picture tube to prevent exposure to X-ray radiation.

The **Test Picture Tube** used for servicing the chassis at the bench should incorporate safety glass and magnetic shielding. The safety glass provide shielding for the tube viewing area against X-ray radiation as well as implosion. The magnetic shield limits the X-ray radiation around the bell of the picture tube in addition to the restricting magnetic effects. When using a picture tube test jig for service, ensure that the jig is capable of handling **50kV** without causing X-ray radiation.

Before returning a serviced Receiver to the owner, the service technician must thoroughly test the unit to ensure that is completely safe to operate. **Do not use a line isolation transformer when testing.**

Leakage Current Cold Check

Unplug the AC cord and connect a jumper between the two plug prongs.

Measure the resistance between the jumpered AC plug and expose metallic parts such as screwheads, antenna terminals, control shafts, etc. If the exposed metallic part has a return path to the chassis, the reading should be between 240kΩ and 5.2MΩ. If the exposed metallic part does not have a return path to the chassis, the reading should be infinite.

Leakage Current Hot Check (Fig. 1)

Plug the AC cord directly into the AC outlet. Do not use an isolation transformer during the check.

Connect a 1.5kΩ 10 watt resistor in parallel with a 0.15μF capacitor between an exposed metallic part and ground. Use earth ground, for example a water pipe.

Using a DVM with a 1000 ohms/volt sensitivity or higher, measure the AC potential across the resistor.

Repeat the procedure and measure the voltage present with all other exposed metallic parts.

Verify that any potential does not exceed 0.75 volt RMS. A leakage current tester (such a Simpson Model 229, Sencore Model PR57 or equivalent) may be used in the above procedure, in which case any current measure must not exceed 0.5 milliamp. If any measurement is out of the specified limits, there is a possibility of a shock hazard and the Receiver must be repaired and rechecked before it is returned to the customer.

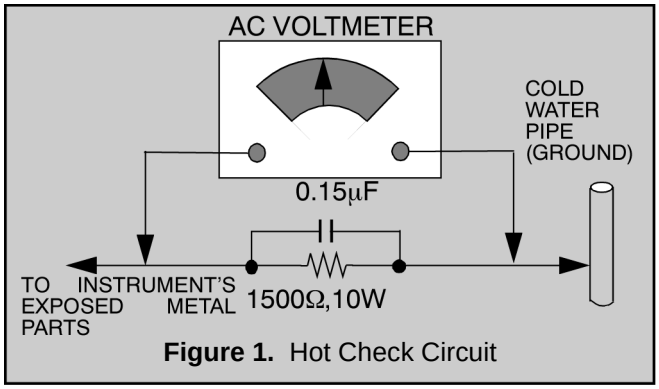

Figure 1. Hot Check Circuit

X-ray Radiation

WARNING: The potential source of X-ray radiation in the Receiver is in the High Voltage section and the picture tube. Refer to "X-Ray Protection Circuit Check & Adjustments" on page 5 to confirm HHS voltage.

High Voltage (CRT Anode)

Set the **brightness, picture, sharpness** and **color** controls to minimum (to obtain dark image). Measure the High Voltage. The high voltage should be **23.75kV ± 1.25kV**. If the upper limit is out of tolerance, immediate service and correction is required.

Note: *It is important to use an accurate, calibrated high voltage meter.*

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Service Notes

Note: *Some components may be affixed with glue. Be careful not to break or damage foil under the component or at the pins of the ICs when removing. Usually applying heat to the component for a short time while twisting with tweezers will break the component loose.*

Leadless Chip Component

(surface mount)

Chip components must be replaced with identical chips due to critical foil track spacing. There are no holes in the board to mount standard transistors or diodes. Some chips capacitor or resistor board solder pads may have holes through the board, however the hole diameter limits standard resistor replacement to 1/8 watt. Standard capacitor may also be limited for the same reason. It is recommended that identical components be used.

Chip resistor have a three digit numerical resistance code - 1st and 2nd significant digits and a multiplier. Example: 162 = 1600 or 1.6kΩ resistor, 0 = 0Ω (jumper).

Chip capacitors generally do not have the value indicated on the capacitor. The color of the component indicates the general range of the capacitance.

Chip transistors are identified by a two letter code. The first letter indicates the type and the second letter, the grade of transistor.

Chip diodes have a two letter identification code as per the code chart and are a dual diode pack with either common anode or common cathode. Check the parts list for correct diode number.

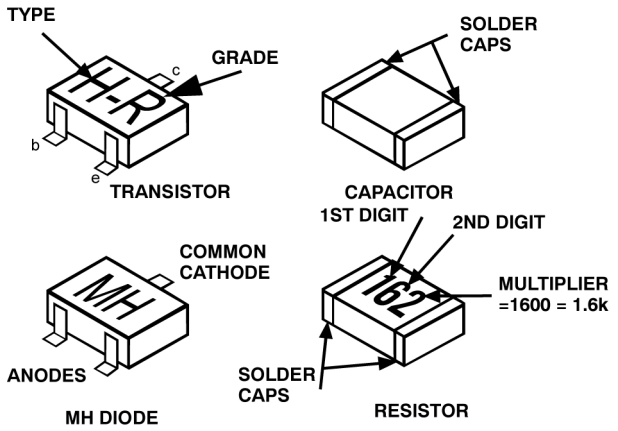
Component Removal

1. Use solder wick to remove solder from component end caps or terminal.
2. Without pulling up, carefully twist the component with tweezers to break the adhesive.
3. Do not reuse removed leadless or chip components since they are subject to stress fracture during removal.

Chip Component Installation

1. Put a small amount of solder on the board soldering pads.
2. Hold the chip component against the soldering pads with tweezers or with a miniature alligator clip and apply heat to the pad area with a 30 watt iron until solder flows. Do not apply heat for more than 3 seconds.

Chip Components

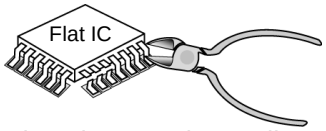


How to Replace Flat-IC

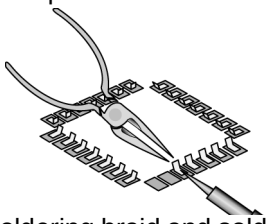
- Required Tools -

- Soldering iron
- Needle nose pliers
- Wire cutters (sharp & small)
- De-solder braids
- Magnifier

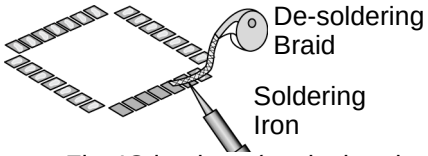
1. Cut the pins of a defective IC with wire cutters. Remove IC from board. If IC is glued to the board, heat the IC and release the IC. See Note above.



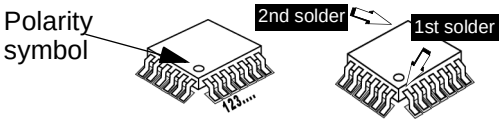
2. Using soldering iron and needle nose pliers remove the IC pins from the board.



3. Using de-soldering braid and soldering iron remove solder from affected are on board (pads).

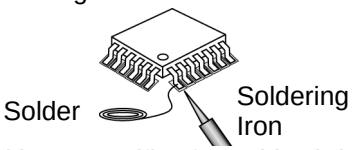


4. Position the new Flat-IC in place (apply the pins of the Flat-IC to the soldering pads where the pins need to be soldered). Determine the positions of the soldering pads and pins by correctly aligning the polarity symbol. Solder pin #1 first, align the IC.

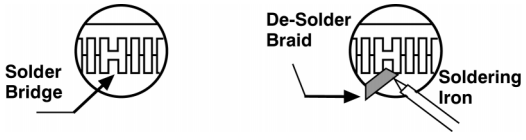


Solder the pin opposite to pin #1. This will assist positioning the IC.

5. Solder all pins to the soldering pads using a fine tipped soldering iron.



6. Check with a magnifier for solder bridge between the pins or for dry joint between pins and soldering pads. To remove a solder bridge, use a de-solder braid as shown in the figure below.



IMPORTANT: To protect against possible damage to the solid state devices due to arcing or static discharge, make certain that all ground wires and CRT DAG wire are securely connected.

CAUTION: The power supply circuit is above earth ground and the chassis cannot be polarized. Use an isolation transformer when servicing the Receiver to avoid damage to the test equipment or to the chassis. Connect the test equipment to the proper ground (⏚) or (⏚) when servicing, or incorrect voltages will be measured.

WARNING: This Receiver has been designed to meet or exceed applicable safety and X-ray radiation protection as specified by government agencies and independent testing laboratories.

To maintain original product safety design standards relative to X-ray radiation and shock and fire hazard, parts indicated with the symbol ⚠ on the schematic must be replaced with identical parts. Order parts from the manufacturer's parts center using the parts numbers shown in this service manual, or provide the chassis number and the part reference number.

For optimum performance and reliability, all other parts should be replaced with components of identical specification.

X-Ray Protection Circuit Check & Adjustments

This test must be performed as final check before the Receiver is returned to the customer. If voltages are out of tolerance, immediate service and correction is required to insure safe operation and to prevent the possibility of premature component failure.

Equipment:

1. Isolation transformer.
2. High voltage meter.
3. Short jumper.
4. Jumper diode (same as D823, PN S3L60P154004). Diode should be rated a minimum of 150V.

Procedure:

1. Connect the Receiver to an isolation transformer. Turn Receiver ON.
2. Apply a monoscope pattern.
3. In Service Mode (see Service Mode Section in this manual) select register CB.
4. Measure TP5 (located near the tuner). Compare the measured value to the left column of the table below. Set CB with value from the right column corresponding to the measured level at TP5. Example, if the measured level at TP5 is 1.03V, set CB to 03.

TP5 MEASUREMENT	SET CB TO (HEX)
0 ~ 0.93V	00
0.93 ~ 0.97V	01
0.97 ~ 1.01V	02
1.01 ~ 1.05V	03
1.05 ~ 1.09V	04
1.09 ~ 1.13V	05
1.13 ~ 1.17V	06
1.17 ~ 1.21V	07

5. Exit Service Mode and shut it OFF.
6. Connect the short jumper between TPD16 and TPD17.
7. Connect the jumper diode between TPD14 and TPD15 (cathode connected to TPD14, anode connected to TPD15, See Fig. 4 for locations).
8. Apply 75VAC to the input of the isolation transformer.
9. Turn Receiver ON.
10. Set PICTURE and BRIGHTNESS to minimum.
11. Slowly increase the voltage at the input of the isolation transformer and confirm HHS voltage measure **29.1KV** when the Receiver starts to go out of sync.
12. Turn Receiver OFF and remove jumper & diode.

Receiver Feature Table

FEATURE\MODEL	CT-13R32E/CE	CT-13R42E/CE (white cabinet)	CT-13R52DE
Chassis	DP358	DP358	EP358
Tuning system	40K	40K	40K
# of channels	181	181	181
Menu language	Eng/Span/Fr	Eng/Span/Fr	Eng/Span/Fr
Closed Caption	X	X	X
V-Chip	X	X	X
75 Ω input	X	X	X
75 Ω adaptor	X	X	X
Dipole antenna	X	X	X
FM radio	X	X	X
Remote Model #	EUR501455	EUR501456 TNQ2AE013 (magnetic)	EUR501455
Picture tube	37GDA85X(M)	37GDA85X(M)	37GDA85X(M)
Comb Filter	2 Line Digital	2 Line Digital	2 Line Digital
V/A norm	V	V	V
Built-in audio power	1.5W x 1 (10%)	1.5W x 1 (10%)	1.5W x 1 (10%)
# of speakers	1	1	1
A/V in (rear/front)	1 (1 / 1)	1 (1 / 1)	1 (1 / 1)
Earphone Jack	X	X	X
Dimensions mm (WxDxH) in	359.2 x 395 x 337.3 14.1 x 15.6 x 13.3	359.2 x 395 x 337.3 14.1 x 15.6 x 13.3	359.2 x 395 x 337.3 14.1 x 15.6 x 13.3
Weight (kg/lbs)	9 / 19.8	9 / 19.8	9 / 19.8
Power source (V/Hz)	120 / 60	120 / 60	120 / 60 / DC
Anode voltage	23.75kV ± 1.25kV	23.75kV ± 1.25kV	23.75kV ± 1.25kV
Video input jack	$1V_{p-p}$ 75Ω, phono jack	$1V_{p-p}$ 75Ω, phono jack	$1V_{p-p}$ 75Ω, phono jack
Audio input jack	500mV RMS 47kΩ	500mV RMS 47kΩ	500mV RMS 47kΩ
A-Board TNP2AH024 Main chassis	EC*	EC*	ED*
C-Board TNP2AA075 CRT drive board	AE*	AE*	AE*
P-Board TNP2AA014 AC-DC Power supply board	N/A	N/A	NIL*

Table 1. **Receiver Features**

Specifications are subject to change without notice or obligation.
Dimensions and weights are approximate.

**** Note:*** *When ordering a replacement board assembly, append an "S" to the board number.*
Example: to order the A-Board for CT-13R32E, the replacement board is TNP2AH024ECS.

Location of Receiver Controls

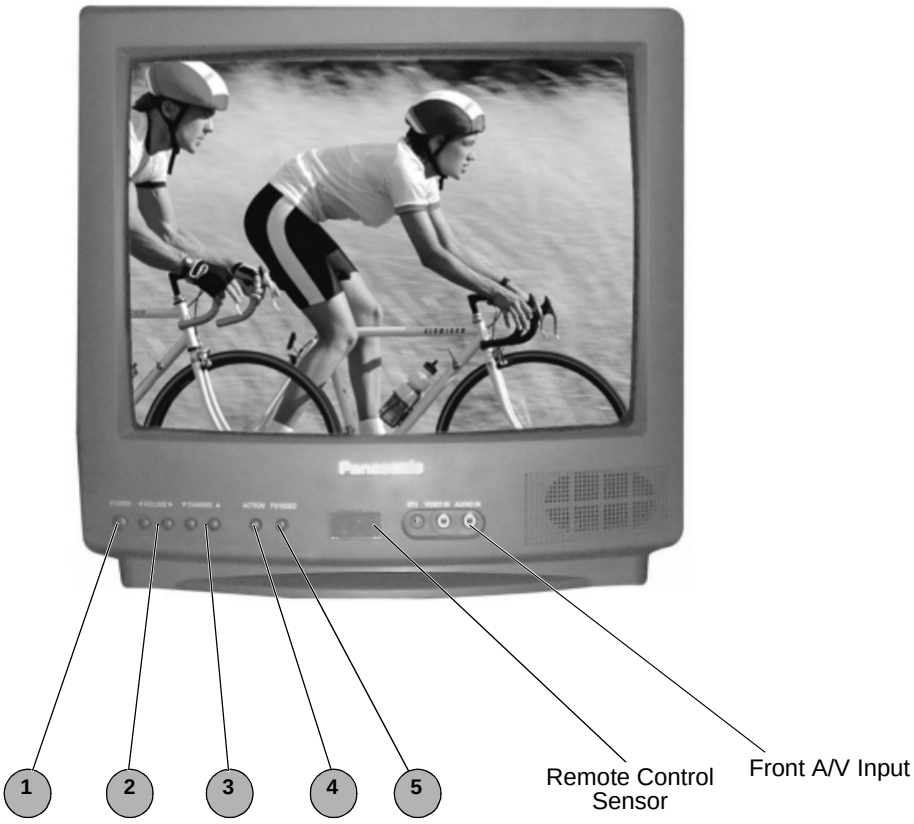


Figure 2. Location of Controls.

Quick Reference Control Operation	
1	**Power Button -** Press to turn ON or OFF.
2	**Volume Buttons -** Press to adjust Sound Level, or to adjust Audio Menus, Video Menus, and select operating features when menus are displayed.
3	**Channel Buttons -** Press to select programmed channels. Press to highlight desired features when menus are displayed. Also use to select Cable Converter box channels after programming Remote Control Infra-red codes (the TV/AUX/CABLE switch must be set in CABLE position).
4	**Action Button -** Press to display Main Menu and access On Screen feature and Adjustment Menus.
5	**TV/Video Button -** Press to select TV or Video Input.

Location of Controls

POWER
Press to turn ON and OFF.

VOL
Press to adjust TV sound and navigate in menus.

ACTION
Press to access menus.

“0”~ “9”
Press numeric keypad to select any channel.

R-TUNE
Press to switch to previously viewed channel or video mode.

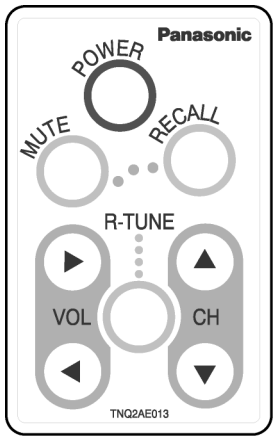
MUTE
Press to mute sound. Press to access and cancel (CC) Closed Caption.

CH
Press to select next channel and navigate in menus.

TV/VIDEO/.FM
Press to select TV, Video or FM Mode.

RECALL
Press to display time, channel, sleep timer, and other options.

EUR501455



TNQ2AE013
Magnetic Remote
(CT-13R42E/CE)

Figure 3. Location of Controls

Disassembly for Service

Back Cover

Remove all the screws marked with an arrow(◄) from the back of the Receiver.

Note: *Screw configuration, type, and number of screws vary depending on the model of the Receiver serviced; various models are covered in this Manual. Reuse hardware when reassembling the Receiver.*

- 2 screws at the top edge of the Receiver.
- 1 screw by the AC cord assembly.
- 1 screw by the A/V jacks.
- 1 screw at the AC/DC receptacle. (CT-13R52DE)

A-Board - Main Chassis

1. Slide the chassis completely out of the guide rails.
2. Stand the Receiver on its edge. The underside of the board is completely accessible for component replacement.

Note: *Some tie-wraps that secure the wire dressings may need to be unfastened for chassis removal.*

C-Board - CRT Output

The board plugs onto the socket on the CRT neck. To release the Focus wire, use a dull object to release the tab on the socket (near the wire opening) and carefully pull on the wire. To connect the Focus wire, press on the tab to lock it then insert the wire in the opening and press on it until it is fully inserted and locked in place.

P-Board - AC/DC Power (CT-13R52DE)

The board is secured to the cabinet (above tuner location) on a metal bracket.

Speakers

Speaker is secured to the cabinet's front with 2 screws.

Keyboard Push Button Assembly

Fastened with screws to the inside of the cabinet front.

Disassembly for CRT Replacement

1. Discharge the CRT as instructed in the **Safety Precautions** (see page 2).
2. Disconnect the yoke (DY) plug, degaussing coil (DEG) plug from the main board.
3. Unplug the CRT 2nd anode button from the main board.
4. Remove the C-Board from the CRT base and unplug the black wire (CRT dag ground) C10.
5. Disconnect the A11, A12, and Speakers plugs from the A-Board.
6. Lift the Main Chassis (A-Board) and all mounted boards completely out with the CRT Board attached.

CRT Replacement

1. Perform **Disassembly for CRT Replacement** procedure.
2. Insure that the CRT H.V. Anode button is discharged before handling the CRT. Read the **Safety Precautions** (see page 2 on handling the picture tube.)
3. Remove the components from the CRT neck and place the cabinet face down on a soft pad.
4. Note the original order for the CRT mounting hardware as they are remove from the CRT mounting brackets at each corner of the CRT.
5. Remove the CRT with the degaussing coil and the dag ground braid attached.
6. Note the original locations and mounting of the degaussing coil and the dag ground assembly to insure proper reinstallation on the replacement CRT.

   To remove and re-mount the degaussing coil: The degaussing coil is held in place by clampers fastened to the CRT corner ears. These clampers must be installed onto the replacement CRT prior to mounting the degaussing coil.

   To remove and re-mount the dag ground braid:
   a. Unhook the coil spring from the bottom corners of the CRT ears.
   b. Release the braid loop from the upper corners of the CRT ears.
7. Mount the dag ground braid on the replacement CRT. Position the degaussing coil with new ties. Dress coil as was on the original CRT.
8. Replace the components on CRT neck and reinstall into cabinet. Verify that all ground wires and circuit board plugs get connected.

Chassis Service Adjustment Procedures

All service adjustments are factory preset and should not require adjustment unless controls and/or associated components are replaced.

Note: *Connect the (-) lead of the voltmeter to the appropriate ground. Use IC801's heat sink when the HOT ground symbol (⏚) is used. Otherwise, use COLD ground (⏚) — Tuner shield, IC451's heat sink or FA2.*

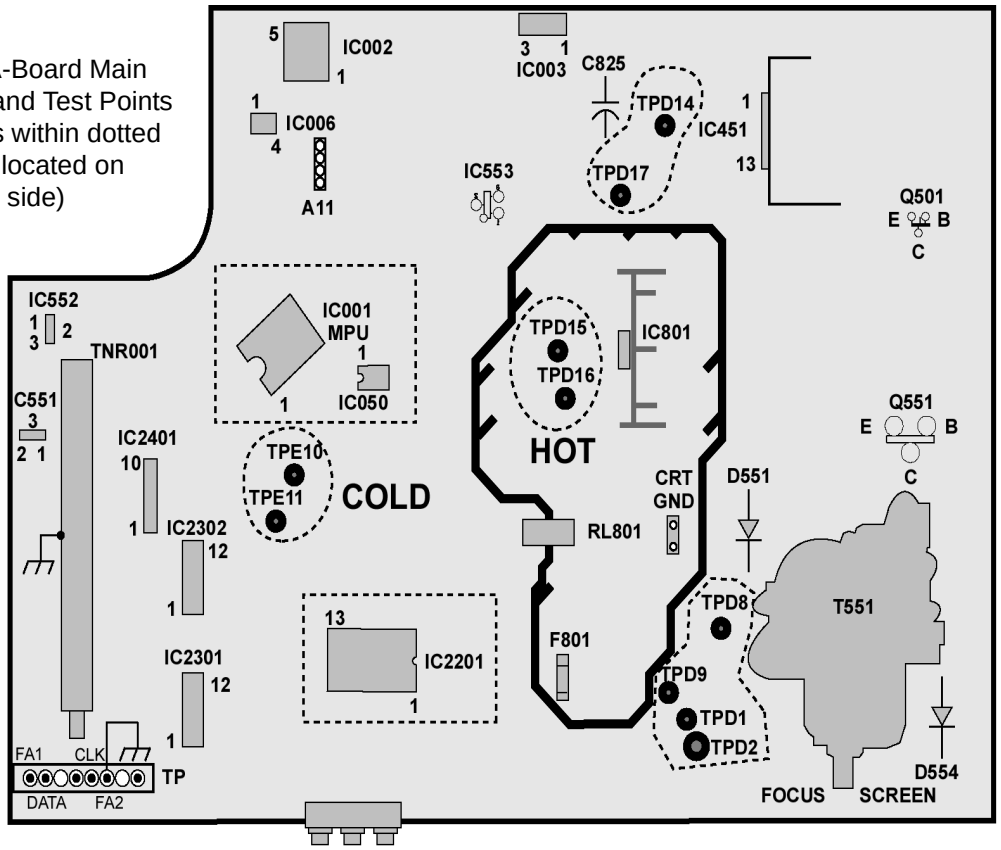


Figure 4. A-Board Main Components and Test Points (Components within dotted areas are located on trace side)

MOMENTARILY CONNECT A JUMPER TO ENTER SERVICE MODE (FA1 to FA2)

130.0V B+ Voltage Confirmation

1. Set the **Bright** and the **Contrast** to Minimum by using the Picture Menu.
2. Connect the DVM between C825 (+ side) or TPD14 and cold ground (⏚).
3. Confirm that B+ voltage is **130.0V ± 2.5V**. This voltage supplies B+ to the Horizontal Output & Flyback circuits.

Source Voltage Chart

120V AC line input. Set the **Bright** and the **Picture** to Minimum by using the Picture Menu. Use cold ground (⏚) for the (-) lead of the DVM.

LOCATION	VOLTAGE
TPD8	23.0V ± 2.0V
TPD9	13.0V ± 2.0V
IC551 Pin3	9.0V ± 0.25V
IC552 Pin3	5.0V ± 0.25V
D554 Cathode	180V ± 15V

Adjust Picture Menu for normalized video adjustments.

High Voltage Check

1. Select an active TV channel and confirm that horizontal is in sync.
2. Adjust Brightness and Contrast using Picture Icon menu so video just disappears.
3. Confirm B+ 131V is within limit.
4. Using a high voltage meter confirm that the High Voltage is **23.75kV ± 1.25kV**.

Purity and Convergence Procedure

Adjustment is necessary only if the CRT or the deflection yoke is replaced or if the setting was disturbed. The complete procedure consists of:

1. Vertical Raster Shift Adjustment. **(Only for Models with Purity/Convergence Assembly with 4 Pairs of Rings)**.
2. Initial static convergence.
3. Setting the purity.
4. Final static convergence.

When the CRT or the Yoke is Replaced

Place the yoke on the CRT neck (do not tighten the clamp).

For a 2-piece assembly (see Fig. 5):

Position purity/convergence assembly as shown and tighten clamp snugly. Remove the hot-melt glue seal on assembly and position like tabs of purity device together at 12 o'clock to reduce its magnetic field effect.

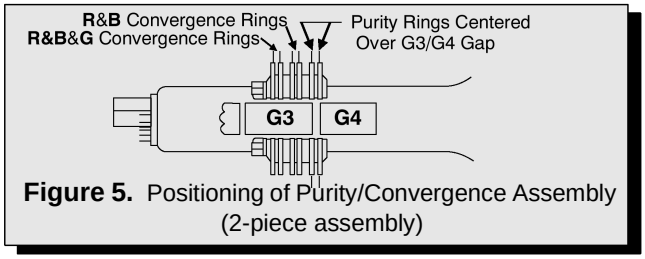


Figure 5. Positioning of Purity/Convergence Assembly (2-piece assembly)

For models using 4 pairs of rings, place the vertical raster shift tabs at 3 o'clock (90º from the purity and convergence tabs, see Fig. 6 and Fig. 7).

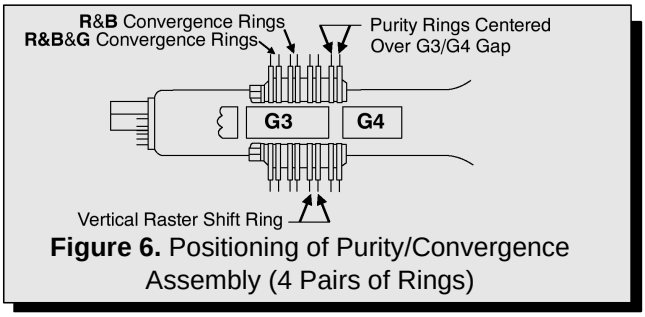


Figure 6. Positioning of Purity/Convergence Assembly (4 Pairs of Rings)

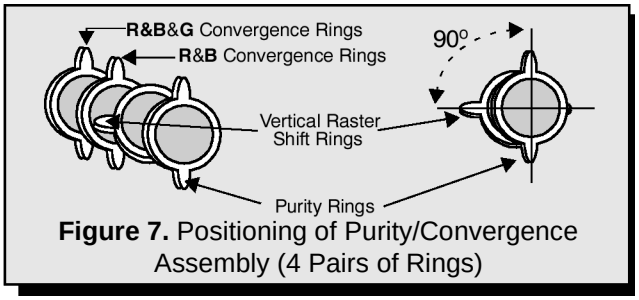


Figure 7. Positioning of Purity/Convergence Assembly (4 Pairs of Rings)

For a 1-piece assembly (see Fig. 8):

Position like tabs of purity devices together at 12 o'clock to reduce any magnetic field effect. (For better results, note part number and look for specifications at Service Center)

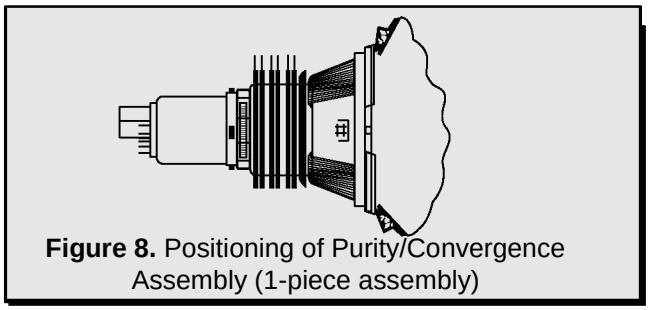


Figure 8. Positioning of Purity/Convergence Assembly (1-piece assembly)

For either assemblies:

Turn the Receiver ON. Operate the Receiver for 60 minutes using the first Purity Check field (white screen) to stabilize the CRT.

Fully degauss the Receiver by using an external degaussing coil.

Slide the deflection yoke back and forth on the neck of the CRT until it produces a near white, uniform raster.

Vertical Raster Shift Adjustment (Only for Models with Purity/Convergence Assembly with 4 Pairs of Rings).

Apply a green pattern with a horizontal line, adjust the Deflection Yoke so that has no tilt, then secure it.

Adjust center line of the pattern with the mechanical center of the CRT, this center is determined by two marks at the side edges of the screen. To adjust the line, once the vertical raster shift tabs are place at 3 o'clock to reduce its magnetic field effect (see Fig. 6 and Fig. 7) open the tabs the same angle from the center, until the center line of the pattern becomes a straight line, centered with the marks of the CRT. (see Fig. 9.)

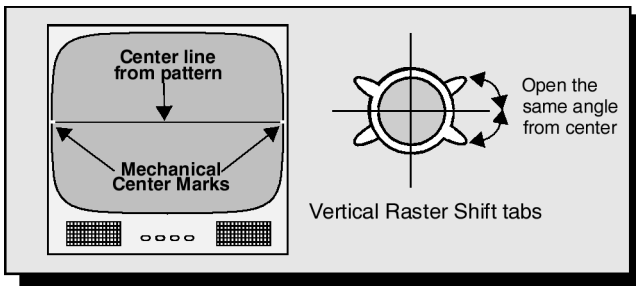


Figure 9. Vertical Raster Shift Adjustment (4 pairs of rings assembly)

Initial Center Static Convergence

Connect a dot/cross hatch generator to the Receiver and tune in a signal. Observe misconvergence at center of the screen only.

Adjust the R & B pole magnets; by separating tabs and rotating to converge blue with red.

Adjust the R & B and R & B & G pole magnets: by separating tabs and rotating to converge blue and red (magenta) with green.

Note: *Precise convergence at this point is not important.*

Purity Adjustment

When the Receiver is in the Service Mode for making electronic adjustments, press the **Recall** button on the Remote Control to enter Purity Check. (See the **Service Adjustments Electronic Controls** procedure).
Operate the Receiver for 60 minutes using the first Purity Check field (white screen) to stabilize the CRT.
Fully degauss the Receiver by using an external degaussing coil.
Press the **Recall** button on the Remote Control again until the Purity Check (green screen) appears.

For a 2-piece assembly (see Fig. 5):

Loosen the deflection yoke clamp screw and move the deflection yoke back as close to the purity magnet as possible.
Adjust the Purity rings to set the vertical green raster precisely at the center of the screen (see Fig. 10).

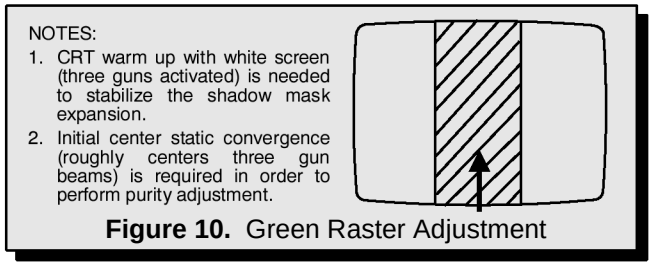

NOTES:
1. CRT warm up with white screen (three guns activated) is needed to stabilize the shadow mask expansion.
2. Initial center static convergence (roughly centers three gun beams) is required in order to perform purity adjustment.

Figure 10. Green Raster Adjustment

Slowly move the deflection yoke forward until the best overall green screen is displayed.

For a 1-piece assembly (see Fig. 8):

Slowly move the deflection yoke and purity rings assembly toward the CRT board and adjust the purity magnet rings to set vertical green raster at center of screen (see Fig. 10).
Gradually move the deflection yoke & purity rings forward and adjust for best overall green screen.

Continue from here for either assemblies:
Tighten the deflection yoke clamp screw.
Press the **Recall** button on the Remote Control again until the purity check (blue screen) and (red screen) appear and observe that good purity is obtained on each respective field.
Press the **Recall** button on the Remote Control again until Purity check (white screen) appears. Observe the screen for uniform white. If purity has not been achieved, repeat the above procedure.

Final Convergence Procedure (see Fig. 11 through Fig. 13):

Note: *Vertical size and focus adjustments must be completed prior to performing the convergence adjustment. Connect a dot pattern generator to the Receiver. The **Brightness** level should not be higher than necessary to obtain a clear pattern.*

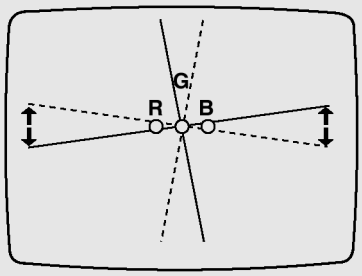
Converge the red and the blue dots at the center of the screen by rotating the R & B pole Static Convergence Magnets.
Align The converged red/blue dots with the green dots at the center of the screen by rotating the R & B & G pole Static Convergence Magnets. Melt wax with soldering iron to reseal the magnets.
Slightly tilt vertically and horizontally (do not rotate) the deflection yoke to obtain a good overall convergence.
If convergence is not reached at the edges, insert permalloy (see following section) from the DY corners to achieve proper convergence. Recheck for purity and readjust if necessary.
After vertical adjustment of the yoke, insert wedge at 11 o'clock position, then make the horizontal tilt adjustment.
Secure the deflection yoke by inserting two side wedges at 3 and 7 o'clock positions.
Apply adhesive between tab (thin portion) of wedge and CRT and place tape over the tab to secure to the CRT.

Permalloy Convergence Corrector Strip (Part No. 0FMK014ZZ)

This strip is used in some sets to match the yoke and CRT for optimum convergence. If the yoke or CRT is replaced, the strip may not be required.
First converge the set without the strip and observe the corners.

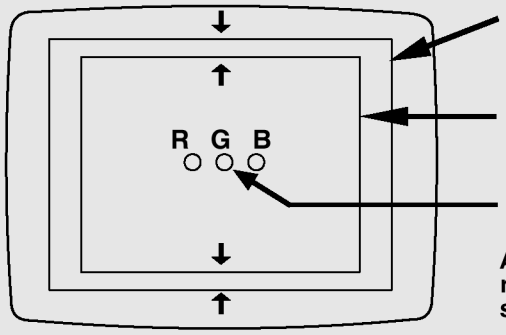
If correction is needed:

1. Place strip between CRT and yoke, in quadrant needing correction. Slowly move it around for desired results.
2. Press adhesive tightly to the CRT and secure with tape.



As the yoke is tilted vertically, the rasters produced by the outside guns rotate in opposite directions.

Figure 11. Vertical Yoke Movement



Raster produced from one of the outside electron beams

Raster from the other side electron beam

Static convergence magnets are set for center convergence

As the yoke is tilted horizontally, one raster gets larger while the other gets smaller

Figure 12. Horizontal Yoke Movement

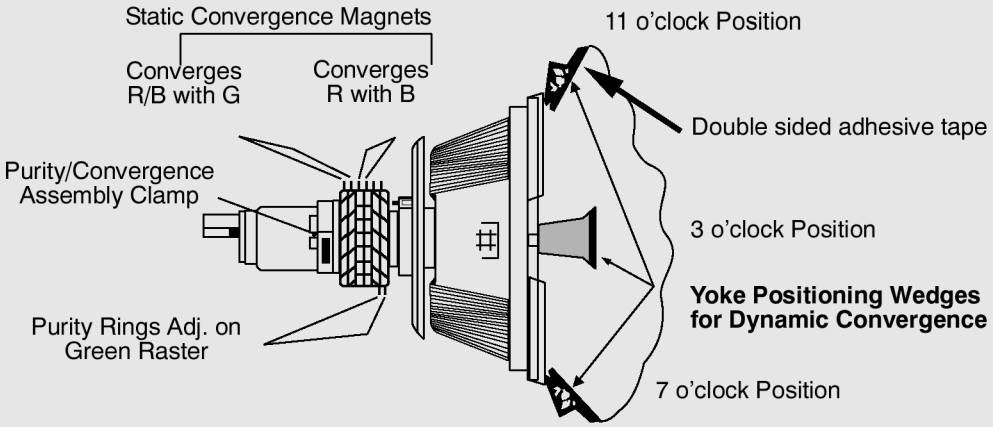


Figure 13. Convergence Magnets and Wedges Location

Note: *For models using 4 pairs of rings assemblies see Fig. 6 for details*

Service Mode (Electronic Controls)

This Receiver has electronic technology using the I²C Bus Concept. It performs as a control function and it replaces many mechanical controls. Instead of adjusting mechanical controls individually, many of the control functions are now performed by using "On Screen Display Menu". (The **Service Adjustment Mode**.)

Note: *It is suggested that the technician reads all the way through and understand the following procedure for Entering/Exiting the **Service Adjustment Mode**; then proceed with the instructions working with the Receiver. When becoming familiar with the procedure, the Flow Chart for Service Mode may be used as a quick guide.*

Quick Entry to Service Mode:

At times when minor adjustments need to be done to the electronic controls, the method of Entering the service Mode without removal of the cabinet back is as follows using the Remote Control:

1. Adjust VOLUME to minimum (0).
2. Set CC Mode (Close Caption) OFF.
3. Select SET-UP icon and select CABLE mode.
4. Select TIMER icon and set SLEEP time for 30, 60 or 90 Min.
5. Press ACTION button twice to exit menus.
6. Tune to the Channel 124.
7. Press the VOL ◀ button (decrease) **on Receiver**. Red "CHK" appears in the left upper corner.

To toggle between Aging and Service modes:

While the "CHK" is displayed on the left top corner of the CRT, pressing the Action and the Volume Up buttons on the Receiver simultaneously will toggle between the modes. Red "CHK" for Service and yellow "CHK" for Aging.

Note: *Three additional indicators appear on screen. One is the five digit usage in hours and the other two are four digits for V-Chip Main and Child ratings. Indicators are hexadecimal numbers.*

8. **Press** the **Power** Button on the **Remote Control** to select one of six Service Adjustment Modes.
   1. **B**= Service VCJ SUB-DATA adjustments.
   2. **C**= Service VCJ CUT-OFF adjustments.
   3. **P**= Service VCJ adjustments.
   4. **S**= Service OPTIONS (PICTURE) adjustments.
   5. **X** = Service AFC adjustments.
   6. "**CHK**" = Normal operation of CHANNEL ▲▼ and VOLUME ◀ ▶.

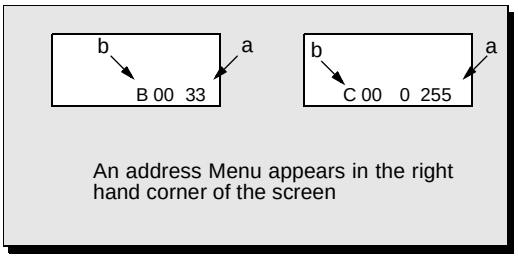


Figure 14. **Service Mode Menu Adjustments.**

Note: *Only the applicable settings for the Receiver serviced will be available (See a in Fig. 14).*

Exiting the Service Mode:

Press the **Action** and the **Power** buttons on the **Receiver** simultaneously for at least 2 seconds.

THE RECEIVER EXITS SERVICE MODE

The Receiver momentarily shuts off; then comes back on tuned to channel 3 with a preset level of sound. Any programmed channels, channels caption data and some others user defined settings will be erased.

IMPORTANT
Always Exit the Service Mode Following Adjustments.

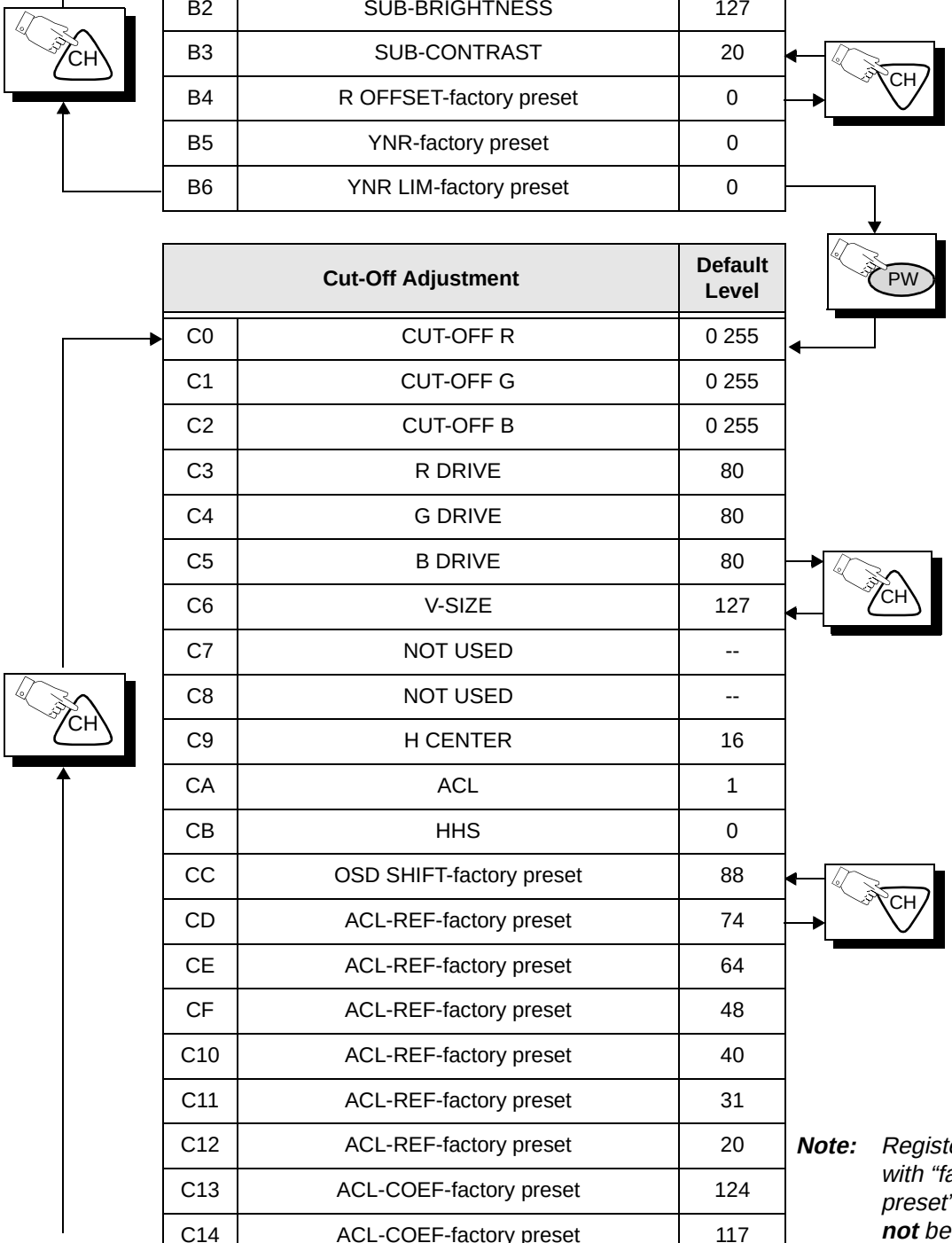
Press the **POWER** Button on the Remote Control to select the Service Adjustment.

For Adjustments:

1. **Press Channel Up/Down** on the **Remote Control** to select one of the available Service Adjustments (**a** in Fig. 14).

Note: *Write Down the original value set (**b** in* Fig. 14*) for each address before modifying anything. It is easy to erroneously adjust the wrong item.*

2. **Press Volume Up/Down** on the **Remote Control** to adjust the level of the selected Service Adjustment (**b** in Fig. 14).

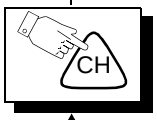


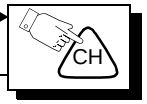
Sub-Data Adjustment		Default Level
B0	SUB-COLOR	33
B1	SUB-TINT	36
B2	SUB-BRIGHTNESS	127
B3	SUB-CONTRAST	20
B4	R OFFSET-factory preset	0
B5	YNR-factory preset	0
B6	YNR LIM-factory preset	0

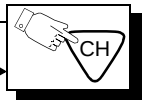
Cut-Off Adjustment		Default Level
C0	CUT-OFF R	0 255
C1	CUT-OFF G	0 255
C2	CUT-OFF B	0 255
C3	R DRIVE	80
C4	G DRIVE	80
C5	B DRIVE	80
C6	V-SIZE	127
C7	NOT USED	--
C8	NOT USED	--
C9	H CENTER	16
CA	ACL	1
CB	HHS	0
CC	OSD SHIFT-factory preset	88
CD	ACL-REF-factory preset	74
CE	ACL-REF-factory preset	64
CF	ACL-REF-factory preset	48
C10	ACL-REF-factory preset	40
C11	ACL-REF-factory preset	31
C12	ACL-REF-factory preset	20
C13	ACL-COEF-factory preset	124
C14	ACL-COEF-factory preset	117

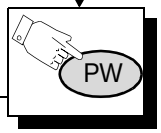
Note: *Registers noted with "factory preset" should **not** be modified.*

Cut-Off Adjustment		Default Level
C15	ACL-COEF-factory preset	94
C16	ACL-COEF-factory preset	80
C17	ACL-WAIT-factory preset	2
C18	ACL-THRESHOLD-factory preset	9
C19	MACROVISION-factory preset	3
C1A	OSD SELECT-factory preset	1
C1B	KILLER ON-factory preset	6
C1C	KILLER OFF-factory preset	20
C1D	KILLER TIME-factory preset	3
C1E	ACC THRESHOLD-factory preset	17
C1F	ACC OFF-factory preset	7
C20	MUTE TIME-factory preset	11

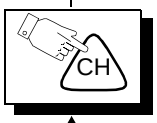


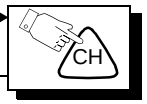


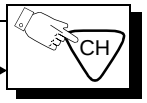


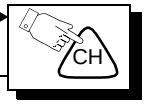


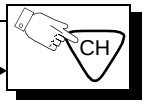
VCJ Adjustment		Default Level
S0	SHARPNESS PW-factory preset	3
S1	SHARPNESS OW-factory preset	3
S2	HALFTONE-factory preset	0
S3	TVC DELAY-factory preset	0
S4	TVY DELAY-factory preset	0
S5	GAMMA FOLDING POINT-factory preset	13
S6	VIDEO Y DELAY-factory preset	0
S7	VIDEO C DELAY-factory preset	0
S8	COMB BPF-factory preset	0
S9	COMB 2D-factory preset	1
SA	COLOR KILLER LEVEL-factory preset	0
SB	KILLER THRESHOLD-factory preset	0
SC	ACC SW-factory preset	0
SD	ACC AMP OFF1-factory preset	100
SE	ACC AMP OFF2-factory preset	0
SF	ACC AMP ON-factory preset	20
S10	ACC AMP CTL-factory preset	3
S11	BGP POSITION-factory preset	21
S12	OSD R-factory preset	30
S13	OSD G-factory preset	30
S14	OSD B-factory preset	30
S15	NOISE KILLER TIME-factory preset	5











Note: *Registers noted with "factory preset" should* ***not*** *be modified.*

VCJ Adjustment (Continued)		Default Level
S16	NOISE KILLER (ACC)-factory preset	50
S17	HV TIMING-factory preset	2

VCJ Adjustment (Black Expansion)		Default Level
P0	FORCE BS-factory preset	1
P1	DET ON/OFF-factory preset	1
P2	ROM SEL-factory preset	3
P3	ROM CURVE-factory preset	2
P4	BS ON/OFF-factory preset	1
P5	BS TIME CONSTANT-factory preset	5
P6	THRESHOLD V-factory preset	4
P7	THRESHOLD F1-factory preset	129
P8	THRESHOLD F1-factory preset	1
P9	THRESHOLD OFF1 (EFFECT OFF)-factory preset	35
PA	THRESHOLD F2-factory preset	99
PB	THRESHOLD F2-factory preset	1
PC	THRESHOLD OFF2 (EFFECT OFF)-factory preset	30
PD	THRESHOLD F3-factory preset	80
PE	THRESHOLD F3-factory preset	1
PF	THRESHOLD OFF3 (EFFECT OFF)-factory preset	21
P10	THRESHOLD ON1-factory preset	37
P11	THRESHOLD ON2-factory preset	33
P12	THRESHOLD ON3-factory preset	25
P13	CURVE1-factory preset	3
P14	CURVE2-factory preset	3
P15	CURVE3-factory preset	3
P16	RATIO1-factory preset	0
P17	RATIO2-factory preset	2
P18	RATIO3-factory preset	3

Note: *Registers noted with "factory preset" should* ***not*** *be modified.*

Other Adjustment		Default Level (Without FM)	Default Level (With FM)
X0	AFCT	60	83
X1	AFCB	29	44
X2	AFCC	42	64
X3	CLOCK	128	128

TO **B** ITEMS

To Check Purity:

When Receiver is in Service Mode (red “CHK” is displayed), place a jumper in the AG connector between the terminals (shorting FB signal to ground). Press the **Recall** Button on the **Remote Control** to enter the White Purity Field Check Mode. Remove the jumper from the AG connector and press **Recall** repeatedly to toggle the Receiver into the Red/Green/Blue Purity Field Check Modes.

Note: if jumper is not removed, colors will be displayed at high luminosity.

In Aging Mode (factory mode, yellow “CHK” is displayed), place a jumper in the AG connector between the terminals. Press **Recall** on the **Remote Control** to enter the Purity Field Check Mode.

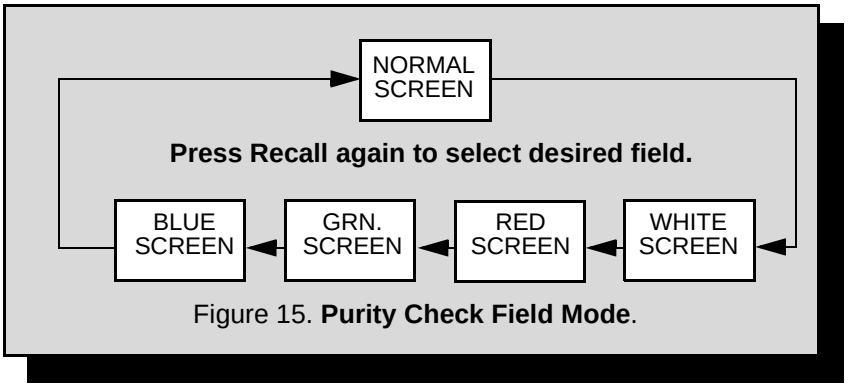


Figure 15. **Purity Check Field Mode**.

Helpful Hints

Entering Service Mode (Back-Open Method)

1. While the Receiver is ON and operating in Normal Mode, momentarily short test point **FA1** (TP8) to Cold Ground (⏚) **FA2** (TP3) A-Board.
   The Receiver enters the Aging Mode.
   Yellow letters “CHK” appear in the upper left corner of the CRT.
   (The Volume Up/Down will adjust rapidly).
2. Simultaneously press the **Action** and the **Volume Up** buttons on the **Receiver** Control Panel.
   The Receiver enters the Service Mode.
   The letter in “CHK” turn red.
   (The Volume Up/Down will adjust normally).
   (All customer controls are set to nominal level).

IMPORTANT
Always Exit the Service Mode Following Adjustments.

Note: *Only applicable settings for the Receiver serviced will be available.*

Notes:

Instructional Flow Chart for Service Mode

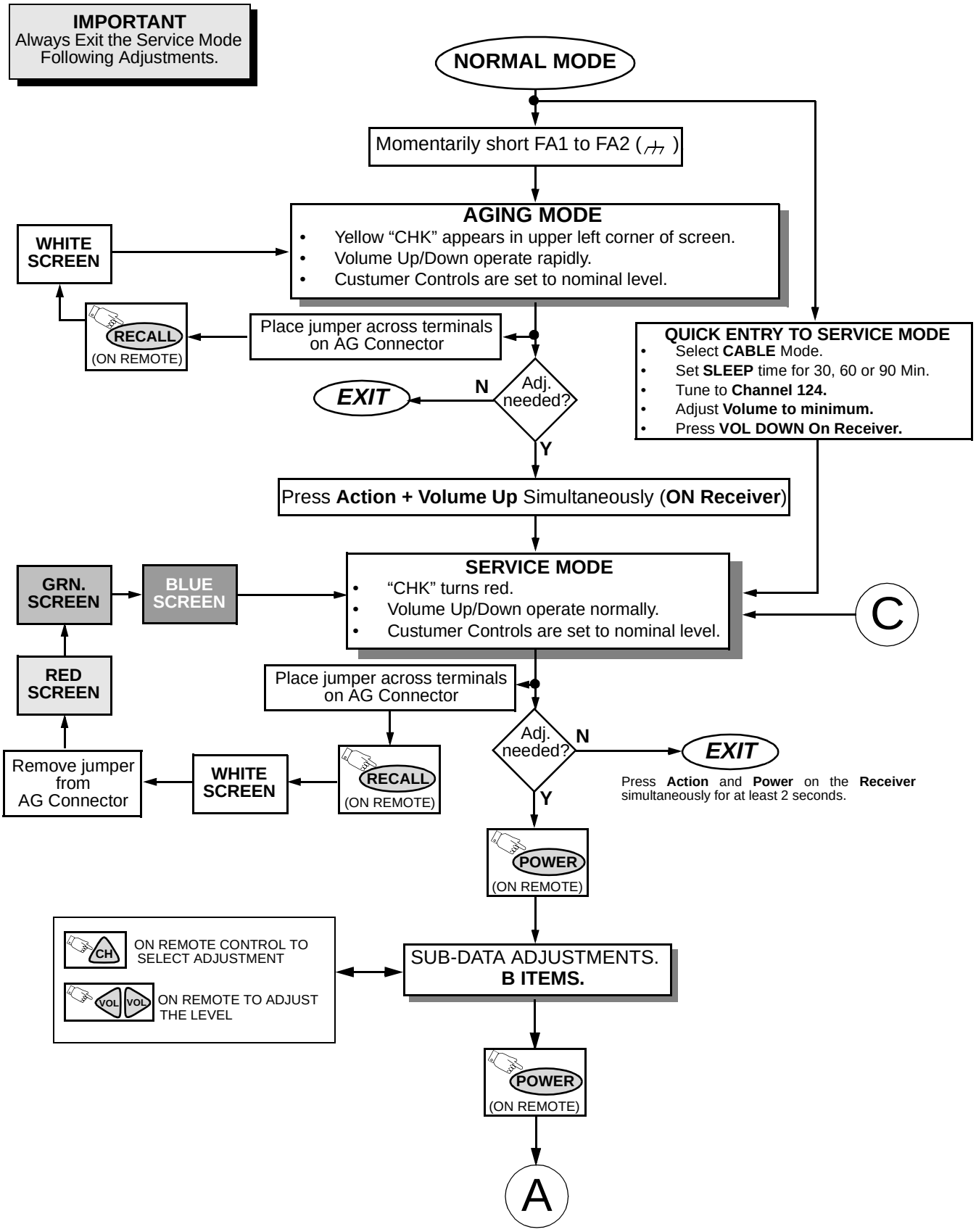
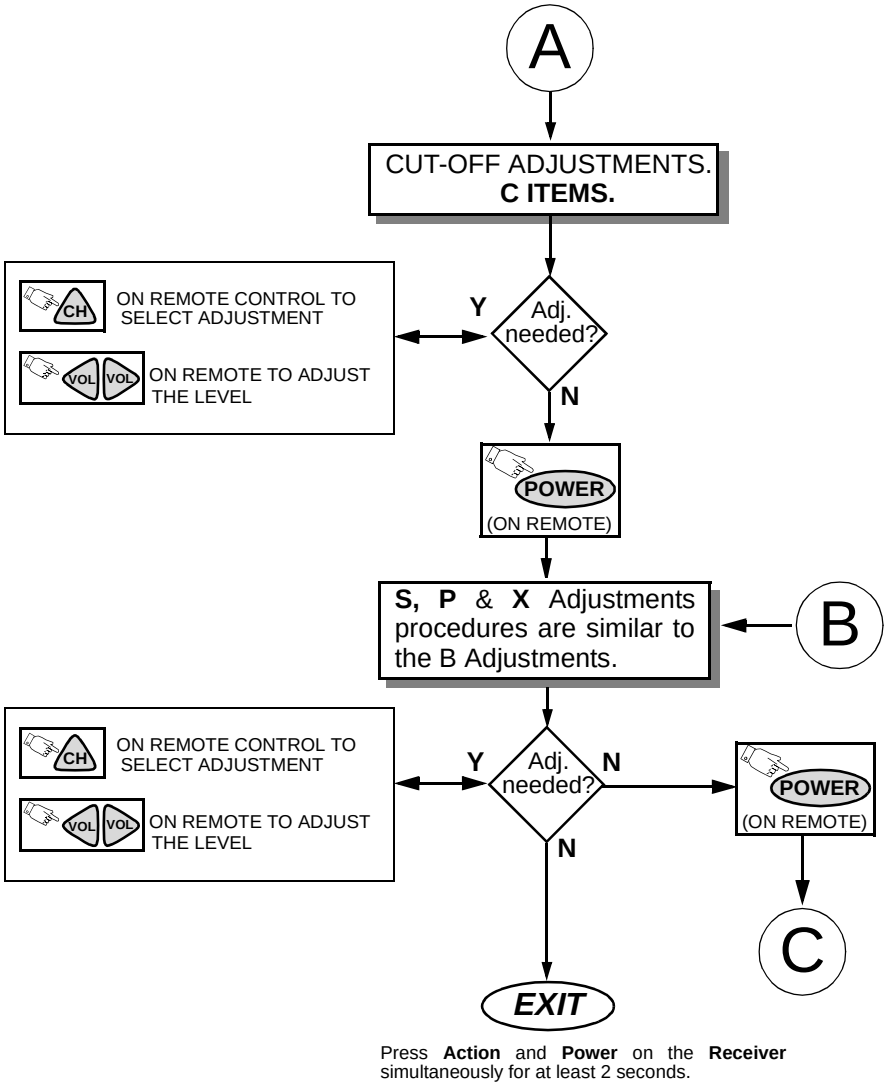


Figure 16. **Flow Chart for Service Mode.**



Note: *Only applicable settings for the Receiver serviced will be available.*

IMPORTANT
Always Exit the Service Mode Following Adjustments.

Figure 17. Flow Chart for Service Mode (Cont.)

Service Adjustments (Electronic Controls)

Note: *It is recommended to allow for a 30 minute warm up period, at high brightness level (use white screen), prior to any picture adjustments.*

Sub-Contrast

Service DAC Adjustment (B3)

This adjustment is factory set. **Do not adjust** unless repairs are made to associated circuit, the CRT Board or when the CRT is replaced.

Preparation:

1. Apply a color bar signal pattern with 87.5% modulation, 70% saturated color bar with a 100 IRE white and 7.5 black.

Note: *The pattern used in this procedure is an EIA color bar pattern with 87.5% modulation with 100 IRE white and 7.5 black. Correlate the information in this procedure to the pattern used if another signal is used.*

2. Preset the following controls:
   - Brightness . . . . . Center.
   - Picture . . . . . Max.
   - Sharpness . . . . . Center.
   - γ Gamma (S5) 15
   - ACL OFF (CA) 00
   - Cut Off G (C1) 00
3. Connect the oscilloscope to the CRT-Board connector C1-2 (TP35). Set the scope time base to 20μs (horizontal).

Procedure:

1. In the Service Mode, select DAC Sub-Contrast Adjustment (B3) and adjust for **2.3 ±0.1Vp-p** between white and black level. (See video waveforms detail, Fig. 18).

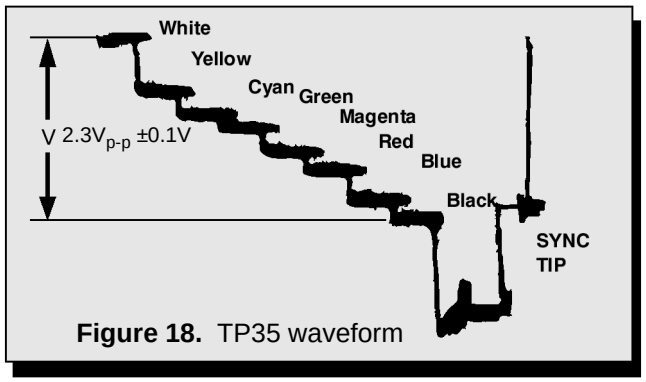


Figure 18. TP35 waveform

2. Following adjustments set S5, CA & C1 to their original settings.
3. Turn Receiver OFF and disconnect test equipment.

Sub-Brightness

Service DAC Adjustment (B2)

Due to the characteristics of this chassis, Sub-brightness adjustments are not necessary. For good brightness level set the register to "127", the default level.

Perform "Sub-Brightness Final Adjustment" on page 23 only if a different brightness level is required for the picture.

Tint/Color Adjustment

Service DAC Adjustment (B1) (B0)

Preparation:

1. Apply a rainbow color bar signal.
2. Preset the following controls:
   - Brightness . . . . . Min.
   - Color . . . . . Center.
   - Tint. . . . . Center.
   - Picture . . . . . Max.
   - Sharpness . . . . . Min.
   - γ, Gamma (S5). . . . 15
   - ACL OFF (CA) 00
3. Connect the oscilloscope to TP37 (or C1-3).

Procedure:

1. In the Service Mode for making electronic adjustments, select DAC Sub-Tint Adjustment (B1). Adjust until the waveform measured is as the one shown in Fig. 19.

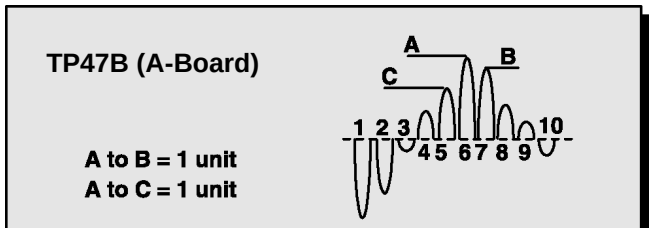


Figure 19. TP37 waveform

2. Connect the oscilloscope to TP35 (C-Board) and GND.
3. Select DAC Sub-Color Adjustment (B0) and adjust for peak to peak amplitude to be **0.7Vp-p ±0.05V** as shown in Fig. 20.

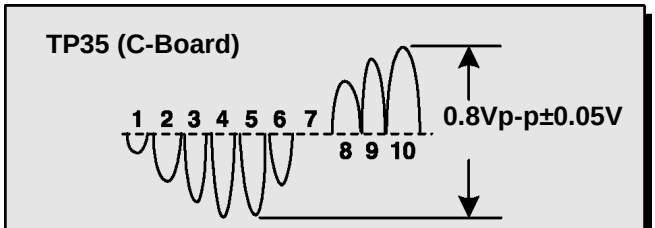


Figure 20. TP35 waveform

4. Following adjustments, reset controls modified during preparation to their original levels
5. Turn Receiver OFF and disconnect test equipment.

White Balance

Service DACs. (C0) (C1) (C2) (C3) (C4) (C5)

Preparation:

1. Turn the Receiver "ON" and allow 30 minutes warm up at high brightness (white screen).
2. Preset the following DACs:
   - C0: Cut Off_R 0 255
   - C1: Cut Off_G 0 255
   - C2: Cut Off_B 0 255
   - C3: Drive_R 80
   - C4: Drive_G 80
   - C5: Drive_B 80

3. Confirm using Black & White pattern and a white screen the color balance (gray scale and white balance). If white balance is required perform the following:

Procedure (Low Lights):

1. Apply a Black & White pattern.
2. Connect a jumper from the base of Q452 to cold ground (⏚) (or apply +2.5V DC to TP1 to defeat the neck protector circuit).
3. Set the Red and Blue Cut-Off registers (C0 and C2) to 00.
4. On the Remote Control, press R-Tune to get a green horizontal line.
5. Connect the scope between GRN Cathode (GK, on the CRT-Board) and cold ground (⏚).
6. View scope trace at Horizontal rate and adjust the Service Mode DAC (C1) level until a scanning period of **140V** above DC ground is measured, as indicated in Fig. 21.

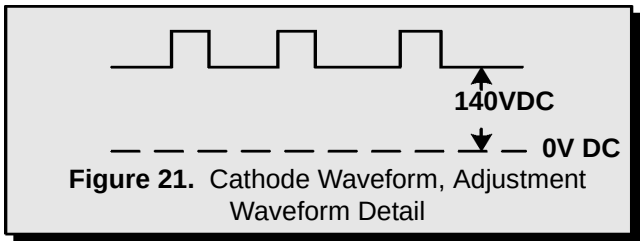


Figure 21. Cathode Waveform, Adjustment Waveform Detail

7. Adjust screen VR (on T551, Flyback) until the green line just becomes visible.
8. Press R-Tune (on Remote Control) to display full screen.
9. Select Red Cut-Off register (C0). Press R-Tune to display a green horizontal line. Increase C0 value (using Volume u) until the line turn yellow (mixing green & red).
10. Press R-Tune to display full screen.
11. Select Blue Cut-Off register (C2) and press R-Tune to see the yellow line. Increase C2 value (using Volume u) until the line becomes white (mixing red blue and green).
12. Press R-Tune to display full screen.
13. Confirm that a good gray scale is displayed when viewing a Black & White pattern.
14. EXIT the Service Mode.

White Balance (High Lights)

1. Using a Black and White pattern and white screen adjust Red Drive, C3, and Blue Drive, C5 to obtain good white level on screen. If white looks reddish, decrease C3, if white looks bluish, decrease C5.
2. Exit Service Mode.
3. In Picture menu change Picture and Brightness from low to high scales and observe black and white tracking.
4. If corrections are required, repeat step 1 until the correct balance is achieved.
5. Following satisfactory High Lights adjustment perform the following White Balance Touch-Up.

White Balance Touch-Up Procedure:

Use this procedure to make minor adjustment to white balance.

1. Enter Service Mode.
2. Apply a black and white (B/W) signal (signal that includes gray tones).
3. Observe low and high brightness areas of a B/W picture for proper tracking. Adjust the following as required for “good gray scale and warm highlights”:

- HIGH LIGHT areas – Adjust Red Drive (C3) and Blue Drive (C5) registers until picture appear best for warm whites.
- LOW LIGHT areas – adjust Red Cut-Off (C0) and Blue Cut-Off (C2) registers until best picture for black-gray.

Due to effect from low level adjustment on high level adjustment, it is recommended that this procedure is done at the end of the adjustments procedure.

4. Exit Service Mode.
5. Remove all external connections made to the Receiver.

Sub-Brightness Final Adjustment

Service DAC Adjustment (B2)

This adjustment should be made last, following other picture adjustments.

Preparation:

1. Turn the Receiver ON and allow 20 minute warm up at high brightness (white screen).
2. Apply a black and white cross pattern.
3. Set PICTURE to Max.
4. Set BRIGHT to Center.

Procedure:

1. In Service Mode, select Sub Bright register (B2).
2. Adjust B2 until the 7.5 IRE section looks same as 3.0 IRE section as seen in Fig. 22.

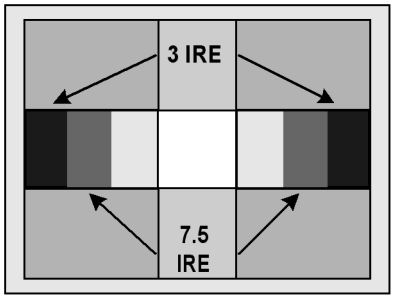


Figure 22. Sub-bright adjustment

3. Exit Service Mode.

Horizontal Centering

Service DAC Adjustment (C9)

Preparation:

Connect a monoscope generator.

Procedure:

1. In the Service Mode, select the Horizontal Centering Adjustment DAC (C9). Adjust it until locations “A” and “B” are even on both sides of screen, as indicated in Fig. 23.
2. EXIT the Service Adjustment Mode.

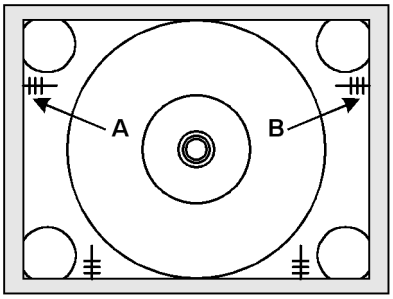


Figure 23. Horizontal Centering

Vertical Size

Service DAC Adjustment (C6)
Preparation:

Connect a monoscope pattern.

Procedure:

1. In the Service Mode, select the Vertical Size Adjustment DAC (C6). Adjust until a perfect circle appears (Upper and lower sections of circle may extend beyond the screen and therefore not visible). See Fig. 24.

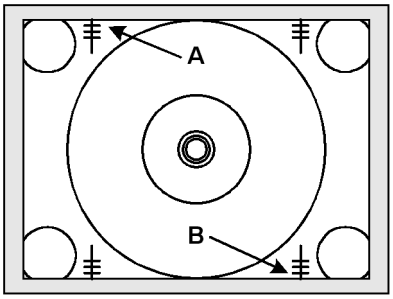


Figure 24. Vertical Size

2. EXIT the Service Adjustment Mode.

DC Power Panel Adjustment (CT-13R52DE)

Preparation:

1. Connect the ground lead of a 12VDC (10Amp capability) power supply to pin 5 of the car cord DC plug. Connect the positive (12VDC) to pin 4 of the car cord DC plug.
2. Connect DVM positive (+) lead to TPP1 and negative (-) lead to P5 (GND) on the P-Board.

Procedure:

1. Turn Receiver ON. Set picture to minimum and leave Receiver on for 10 minutes prior to making adjustments.
2. After aging, apply a monoscope pattern.
3. Verify that the applied power is at 12VDC.
4. Set PICTURE and BRIGHTNESS controls to minimum.
5. Turn R855 (on P-Board) fully counterclockwise.
6. Monitor the DVM reading at TPP1 while turning R855 clockwise and stop adjusting when DVM reads 131.0V ± 1.0VDC.
7. Return PICTURE and BRIGHTNESS controls to normal settings.
8. Vary the power supply from 10VDC to 16VDC and confirm that B+ voltage at TPP1 is less than 133VDC.
9. Confirm that current is less than 6Amp at 12VDC power supply input.
10. Return controls to normal.

Clock Adjustment (X3)

Preparation:

Connect the frequency counter from TP5 (IC001 Pin 11) to cold ground (⏚).

Note: *Frequency Counter probe capacitance should be 8pF or less.*

Procedure:

1. Turn the Receiver "OFF" with the AC power applied.
2. Measure TP5 (IC001 pin 11) for the frequency of the waveform and record the reading.

Note: *Pin 11 measurement must have at least four digits of resolution following the decimal point. Example: 000.0000*

3. Turn the Receiver back "ON".
4. Place the Receiver into Service Mode for making electronic adjustment, select the Clock Adjustment DAC (X3).
5. Calculate and set X3 based on the following formula:

$$X3 = 128 + 0.9 \times 10^{6\frac{\{(TP5 - 125)\}}{125}}$$

Note: *Pin 11 measurement will not change regardless of the value stored in X3.*

Service Adjustments (Mechanical Controls)

Focus (part of T551)

Preparation:
Connect a Signal generator and select a dot pattern.

Procedure:
Adjust the FOCUS control VR to obtain the sharpest and clearest dot pattern.

a. Adjust for best center.
b. Adjust for best area between the center and top right corner.

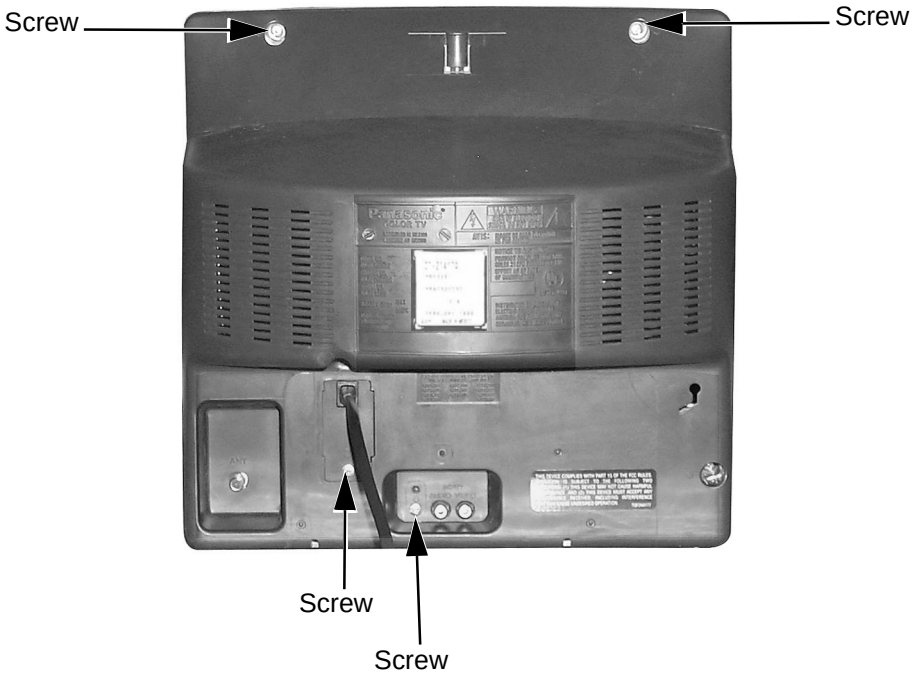


Figure 25. Back Cover Removal (CT-13R32E/CE)

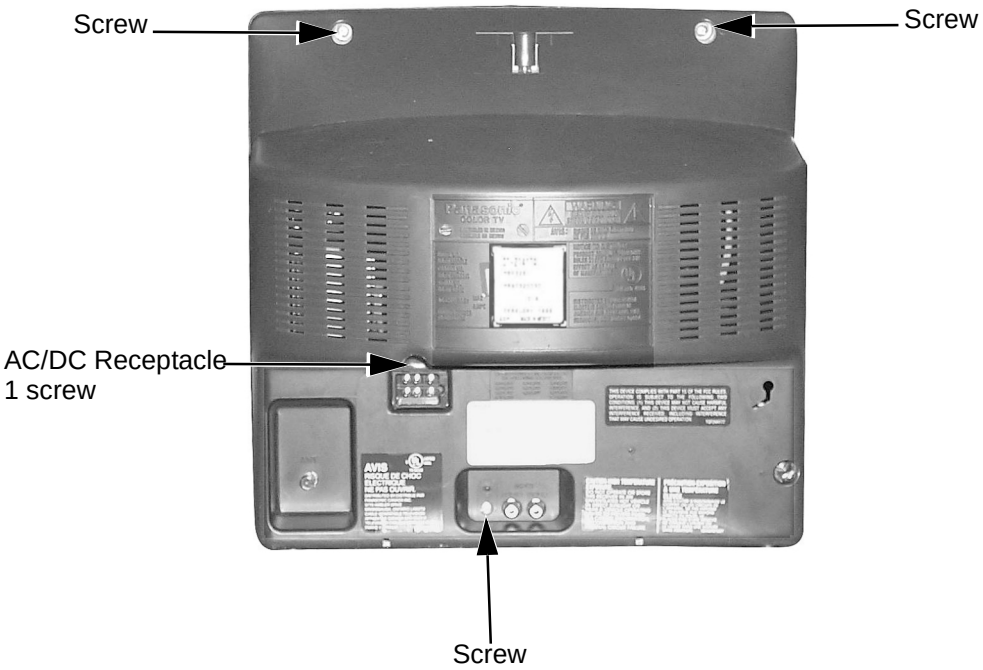
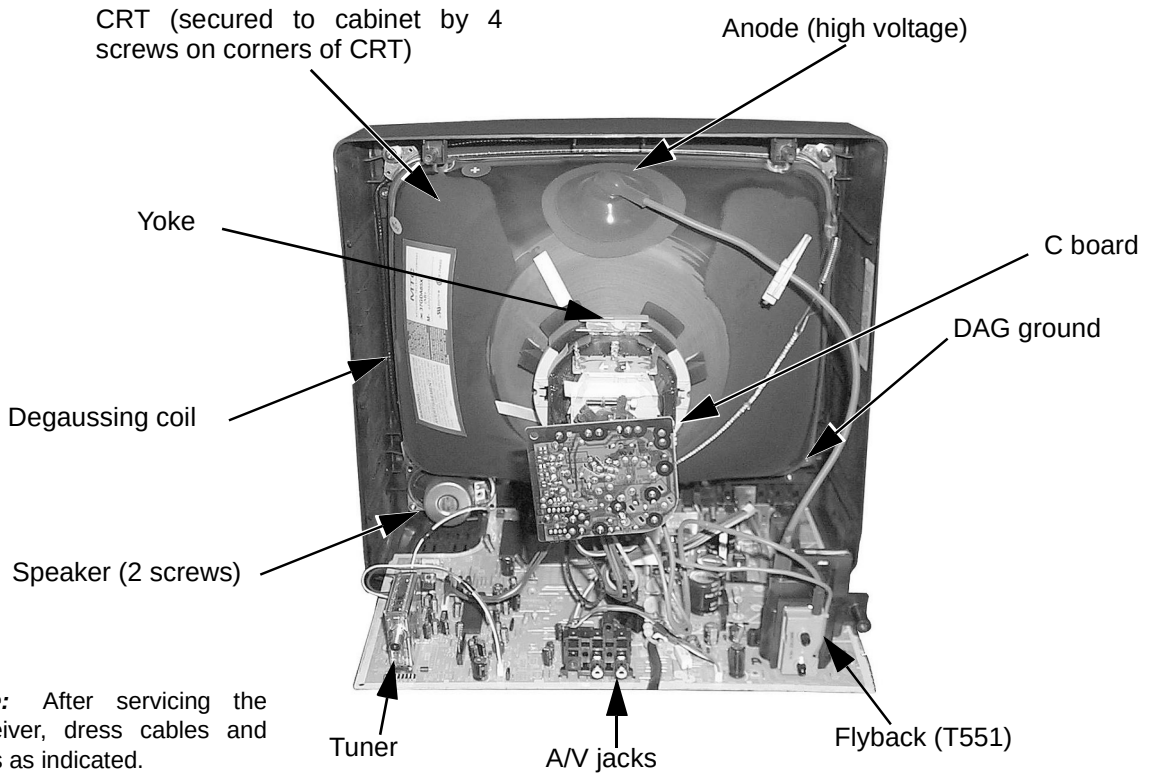
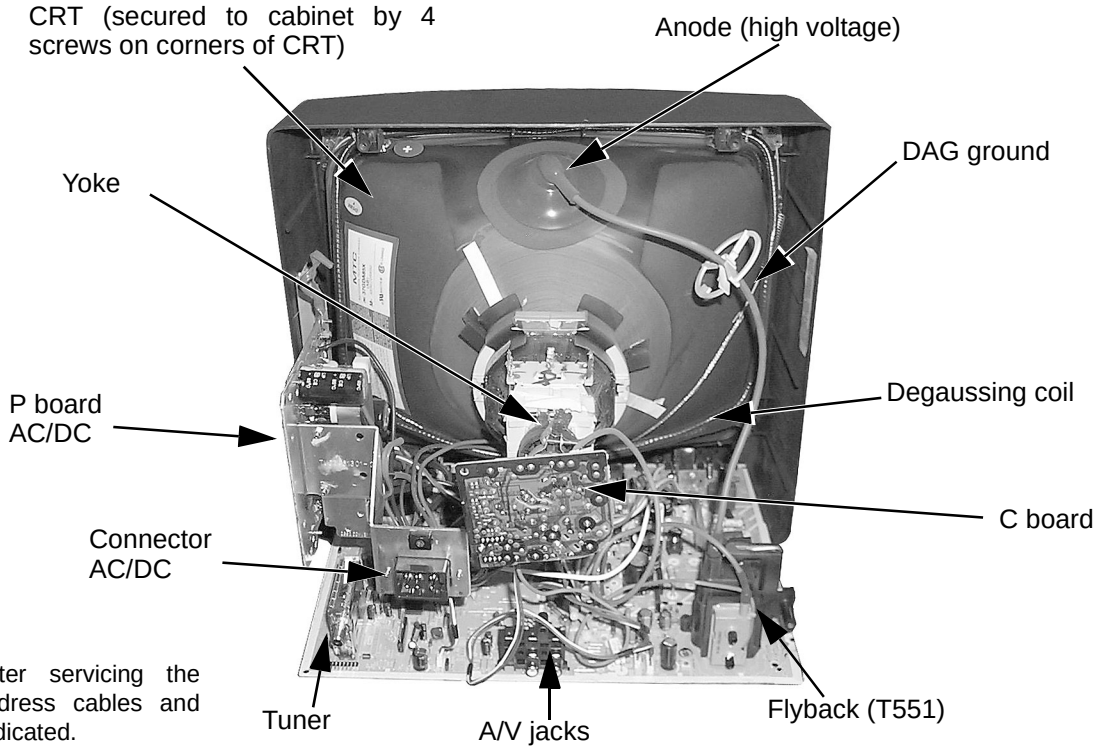


Figure 26. Back Cover Removal (CT-13R52DE)



Note: After servicing the Receiver, dress cables and wires as indicated.

Figure 27. Rear View (CT-13R32E/CE)



Note: After servicing the Receiver, dress cables and wires as indicated.

Figure 28. Rear View (CT-13R52DE)

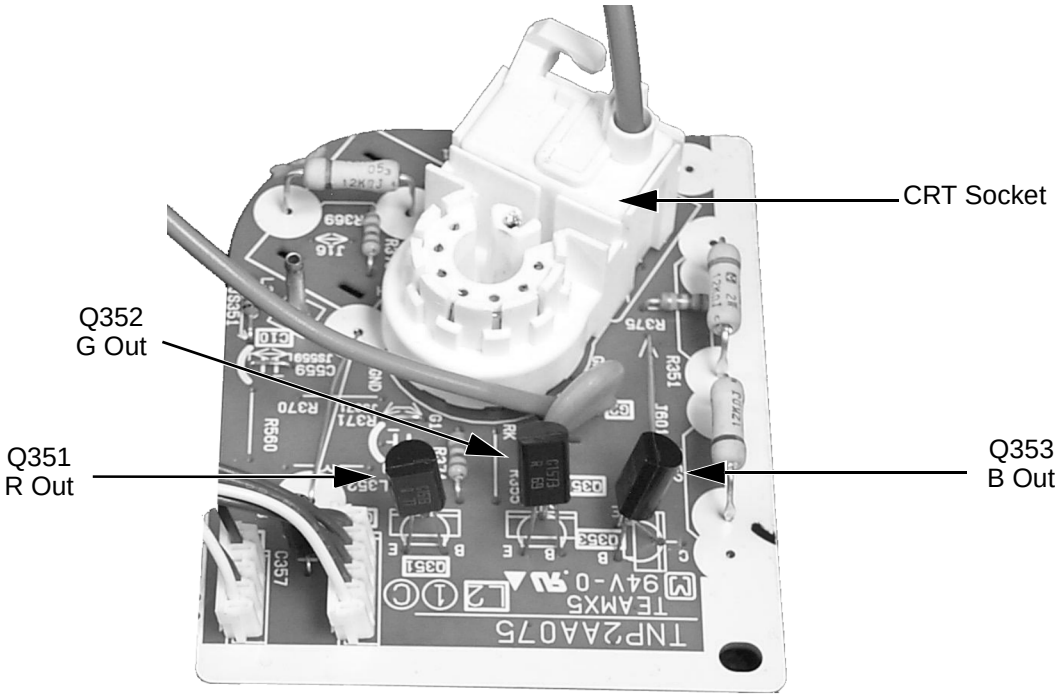


Figure 29. C-Board component locations

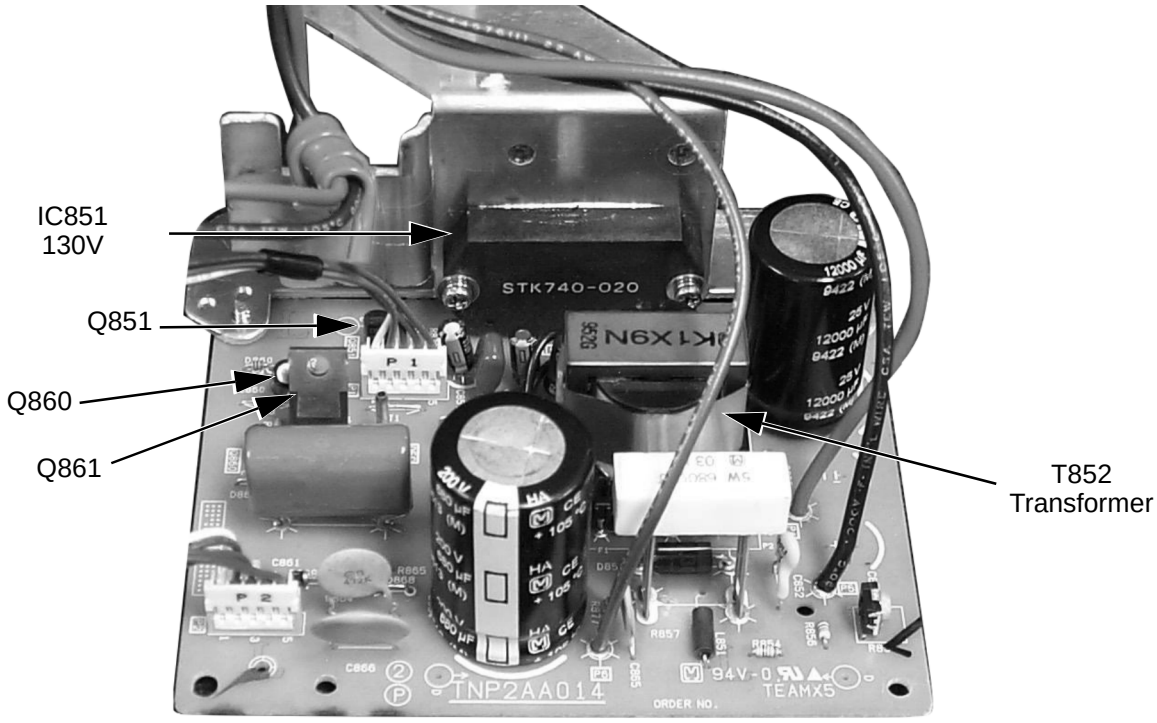


Figure 30. P-Board (CT-13R52DE)

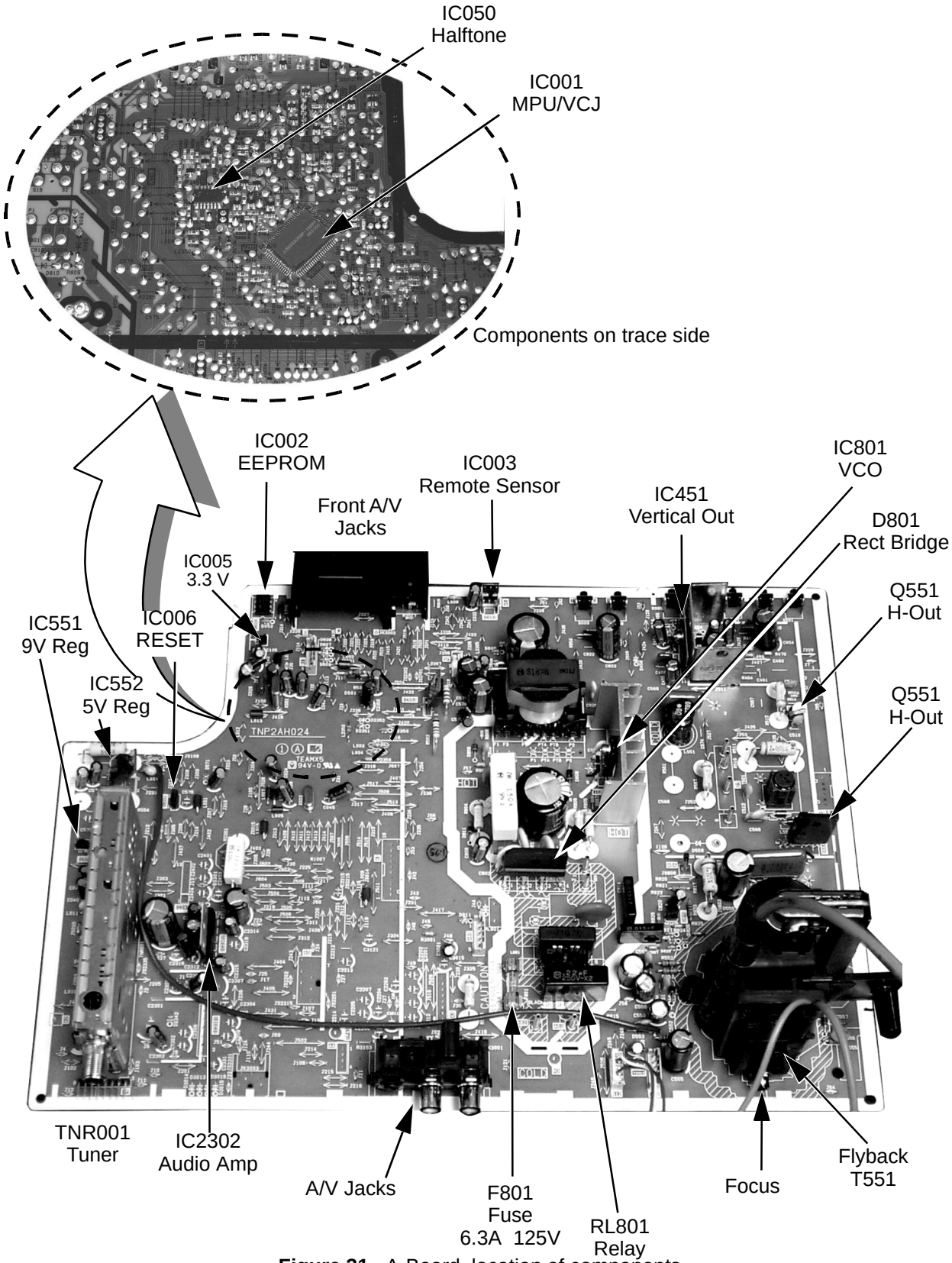


Figure 31. A-Board, location of components

Notes:

Notes:

REPLACEMENT PARTS LIST

Models: CT-13R32E/CE, CT-13R42E/CE & CT-13R52DE

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF NO.	PART NO.	DESCRIPTION
		CAPACITORS
C001	**ECJ2VF1H103Z**	**CAP,C .01UF-Z-50V**
C002	ECJ2VB1H471K	CAP,C 470PF-K-50V
C003	ECA1HM4R7B	CAP,E 4.7UF-50V
C004	ECJ2VC1H150J	CAP,C 15PF-J-50V
C005	ECJ2VC1H150J	CAP,C 15PF-J-50V
C008	ECJ2VF1H104Z	CAP,C .1UF-Z-50V
C009	ECA1CM470B	CAP,E 47UF/16V
C010	ECJ2VF1H104Z	CAP,C .1UF-Z-50V
C011	ECA1CM101B	CAP,E 100UF/16V
C015	ECJ2VB1C224K	CAP,C .22UF-K-16V
C016	ECJ2VC1H101J	CAP,C 100PF-J-50V
C017	ECJ2VB1C104K	CAP,C .1UF-K-16V
C018	ECJ2VC1H151J	CAP,C 15PF-J-50V
C020	ECJ2VB1C104K	CAP,C .1UF-K-16V
C022	ECJ2VC1H101J	CAP,C 100PF-J-50V
C023	ECJ2VC1H151J	CAP,C 15PF-J-50V
C024	ECA1CM470B	CAP,E 47UF/16V
C025	ECJ2VB1C104K	CAP,C .1UF-K-16V
C026	ECJ2VB1C104K	CAP,C .1UF-K-16V
C027	ECJ2VF1H104Z	CAP,C .1UF-Z-50V
C028	ECJ2VB1C104K	CAP,C .1UF-K-16V
C029	ECQB1H333JM3	CAP,P .033UF-J-50V
C031	ECA1HMR22B	CAP,E .22UF-50V
C032	ECA1VM470B	CAP,E 47UF/35V
C033	ECJ2VC1H390J	CAP,C 39PF-J-50V
C034	ECJ2VF1H103Z	CAP,C .01UF-Z-50V
C035	ECA1HM010B	CAP,E 1UF-50V
C036	ECJ2VF1H103Z	CAP,C .01UF-Z-50V
C037	ECA1HM0R1B	CAP,E 0.1UF/50V
C038	ECA1VM470B	CAP,E 47UF/35V
C040	ECA1CM470B	CAP,E 47UF/16V
C041	ECA1HM2R2B	CAP,E 2.2UF-50V
C042	ECJ2VF1H104Z	CAP,C .1UF-Z-50V
C043	ECA1CM470B	CAP,E 47UF/16V
C044	ECJ2VC1H471J	CAP,C 470PF-J-50V
C045	ECA1HM0R1B	CAP,E 0.1UF/50V
C046	ECJ2VB1C104K	CAP,C .1UF-K-16V
C047	ECJ2VC1H220J	CAP,C 22PF-J-50V
C048	ECJ2VC1H220J	CAP,C 22PF-J-50V
C050	ECA1CM101B	CAP,E 100UF/16V
C051	ECJ2VF1H104Z	CAP,C .1UF-Z-50V
C054	ECJ2VF1H103Z	CAP,C .01UF-Z-50V
C055	ECJ2VC1H560J	CAP,C 56PF-J-50V *CT-13R32E/CE CT-13R42E/CE*
C103	ECA0JM331B	CAP,E 330UF-6.3V
C104	ECJ2VF1H103Z	CAP,C .01UF-Z-50V
C105	ECA0JM101B	CAP,E 100UF-6.3V
C201	ECJ2VB1H332K	CAP,C 3300PF-K-16V
C350	ECA1CM101B	CAP,E 100UF/16V
C351	ECJ2VB1H471K	CAP,C 470PF-K-50V

REF NO.	PART NO.	DESCRIPTION
C352	ECJ2VB1H391K	CAP,C 390PF-K-50V
C353	ECJ2VB1H471K	CAP,C 470PF-K-50V
C354	ECKW3D102KBN	CAP,C .001UF-K-2KVDC
C357	EEANA1E1R0B	CAP,E 1.0UF-25V
C361	ECJ2VC1H151J	CAP,C 150PF-J-50V
C362	ECJ2VC1H151J	CAP,C 150PF-J-50V
C363	ECJ2VC1H151J	CAP,C 150PF-J-50V
C451	ECA1CHG470B	CAP,E 47UF-16V
C452	ECSF1EE105VB	CAP,E 1.0UF-25V
C453	ECEA1HFS3R3B	CAP,E 3.3UF-50V
C454	ECA1EM102E	CAP,E 1000UF-25V
C455	ECA1EHG101B	CAP,E 100UF-25V
C456	ECQB1H103JM3	CAP,P .01UF-J-50V
C459	ECA1VHG471E	CAP,E 470UF-35V
C462	ECA1HM4R7B	CAP,E 4.7UF-50V
C502	ECJ2VC1H471J	CAP,C 470PF-J-50V
C503	ECJ2VF1H104Z	CAP,C .1UF-Z-50V
C504	ECJ2VF1H104Z	CAP,C .1UF-Z-50V
C510	ECCR2H100D5	CAP,C 10PF-D-500V
C511	ECKR2H821KB5	CAP,C 820PF-K-500V
C512	ECKR2H101KB5	CAP,C 100UF-K-500V
C531	**ECA1HM220B**	**CAP,E 22UF-50V**
C551	**ECA1VM331B**	**CAP,E 330UF-35V**
C552	ECA1EM221B	CAP,E 220UF-25V *CT-13R52DE*
C553	ECKR2H561KB5	CAP,C 560PF-K-500V *CT-13R52DE*
C554	ECKR2H561KB5	CAP,C 560PF-K-500V
C555	**ECA2EM220E**	**CAP,E 22UF-250V**
C556	**ECA1CM471B**	**CAP,E 470UF-16V**
C557	ECKR2H222KB5	CAP,C 2200PF-K-500V
C559	ECA1HM220B	CAP,E 22UF-50V *CT-13R52DE*
C560	ECEA1HN010UB	CAP,E 1UF/50V
C561	ECKR2H561KB5	CAP,C 560PF-K-500V
C563	**ECWH12H752JS**	**CAP,P .0075UF-J-1.2KV**
C565	**ECKW3D681JBR**	**CAP,C 680PF-J-2KV**
C566	**ECKW3D181JBP**	**CAP,C 180PF-J-2KV**
C569	**ECWF2304JBB**	**CAP,M .3UF-J-200V**
C570	ECA1CM222E	CAP,E 2200UF-16V
C571	ECA1HM220B	CAP,E 22UF-50V
C572	ECA1HM100B	CAP,E 10UF/50V
C573	ECA1CM101B	CAP,E 100UF/16V
C575	ECA0JM222B	CAP,E 2200UF-6.3V
C577	ECA1CM101B	CAP,E 100UF/16V
C578	ECA0JM332B	CAP,E 3300PF-6.3V
C605	ECJ2VF1H103Z	CAP,C .01UF-Z-50V
C606	ECA0JM221B	CAP,E 220UF-6.3V
C801	**ECKWAE472ZED**	**CAP,C 4700PF-Z-500V**
C802	**ECKWAE472ZED**	**CAP,C 4700PF-Z-500V**
C803	**ECKWAE472ZED**	**CAP,C 4700PF-Z-500V**
C805	**EC0S2DG151DG**	**CAP,E 151UF/200V**
C806	ECQM4103KZW	CAP,P .01UF-K-400V
C807	**ECKR3A821KBP**	**CAP,C 820PF-K-1KV**

REPLACEMENT PARTS LIST

Models: CT-13R32E/CE, CT-13R42E/CE & CT-13R52DE

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF NO.	PART NO.	DESCRIPTION	
C808	ECA1VM101B	CAP,E 100UF-35V	
C809	ECKR1H101KB5	CAP,C 100PF-K-50V	
C810	ECKR1H471KB5	CAP,C 470PF-K-50V	
C812	**ECQU2A224MVA**	**CAP,P .22UF-M-250VAC**	
C813	**ECQU2A153MVA**	**CAP,P .015UF-M-250VAC**	
C814	**ECQU2A153MVA**	**CAP,P .015UF-M-250VAC**	
C820	ECA1CM101B	CAP,E 100UF/16V	
C821	ECJ2VF1H103Z	CAP,C .01UF-Z-50V	
C822	ECKR3A221KBP	CAP,C 220PF-K-1KV	*CT-13R32E/CE CT-13R42E/CE*
C823	**ECA1HM471B**	**CAP,E 470UF-50V**	***CT-13R32E/CE CT-13R42E/CE***
C824	ECKR3A471KBP	CAP,C 470PF-K-1KV	
C825	**EEUMG2C221S**	**CAP,E 220UF-160V**	
C826	ECKR3A471KBP	CAP,C 470PF-K-1KV	
C827	ECA1CM221B	CAP,E 220UF-16V	
C828	**ECA160V33UE**	**CAP,E 33UF/160V**	
C850	ECQM1104JZW	CAP,P .10UF-J-100V	*CT-13R52DE*
C851	**EC0S1EP123BS**	**CAP,E .012F-25V**	***CT-13R52DE***
C852	ECKW3D391JBP	CAP,C 390PF-J-2KVDC	*CT-13R52DE*
C854	**EC0S2DA681C4**	**CAP,E 680UF/200V**	***CT-13R52DE***
C857	ECA1CM330B	CAP,E 33UF-16V	*CT-13R52DE*
C858	ECQB1H104JM3	CAP,P .1UF-J-50V	*CT-13R52DE*
C859	ECA1CM471GB	CAP,E 470UF-16V	*CT-13R52DE*
C860	ECA1CM470B	CAP,E 47UF/16V	*CT-13R52DE*
C861	ECQE4105KZB	CAP,P 1.0UF-K-400V	*CT-13R52DE*
C864	ECKW2H472KB5	CAP,C 4700PF-K-500V	*CT-13R52DE*
C865	ECKR2H103ZU	CAP,C .01UF-Z-500V	*CT-13R52DE*
C866	ECKW2H103KB5	CAP,C .01UF-K-500v	*CT-13R52DE*
C871	ECA1HM100B	CAP,E 10UF/50V	*CT-13R52DE*
C2311	ECA1VM102E	CAP,E 1000UF-35V	
C2312	ECEA1HN010UB	CAP,E 1UF/50V	
C2313	ECA1EM101B	CAP,E 100UF-25V	
C2314	ECA1CM100B	CAP,E 10UF-16V	
C2315	ECA1HM010B	CAP,E 1UF-50V	
C2317	ECA1CM102B	CAP,E 1000UF/16V	
C2321	ECA1CM100B	CAP,E 10UF-16V	
C2330	ECA1CM100B	CAP,E 10UF-16V	
C2350	ECA1HM4R7B	CAP,E 4.7UF-50V	
C3001	ECA1HM0R1B	CAP,E 0.1UF/50V	
		DIODES	
D002	MA165TA5VT	DIODE, SWITCHING	*CT-13R32E/CE CT-13R42E/CE*
D006	MA4330HTA	DIODE	
D011	MA165TA5VT	DIODE, SWITCHING	*CT-13R52DE*
D052	MA4068MTA	DIODE, ZENER	
D451	ERA15-01V3	DIODE, RECTIFIER	
D452	MA4047MTA	DIODE	
D453	MA165TA5VT	DIODE, SWITCHING	
D454	MA165TA5VT	DIODE, SWITCHING	
D502	MA4047MTA	DIODE	
D531	**AS01V0**	**DIODE**	

REF NO.	PART NO.	DESCRIPTION	
D551	**D1NL20UV70**	**DIODE**	
D553	AU02V0	DIODE	*CT-13R52DE*
D554	**AU02V0**	**DIODE**	
D561	**AU02V0**	**DIODE**	
D571	MA165TA5VT	DIODE, SWITCHING	
D606	MA165TA5VT	DIODE, SWITCHING	
D607	MA152KTX	DIODE	
D608	MA152KTX	DIODE	
D609	MA152KTX	DIODE	
D801	**D3SBA60-4103**	**DIODE**	
D806	**TAP2AA0001**	**DIODE (THERMISTOR)**	
D808	SARS01V1	DIODE	
D809	AG01V0	DIODE	
D810	AG01V0	DIODE	
D811	AG01V0	DIODE	
D812	**MA4068MTA**	**DIODE, ZENER**	
D820	MA165TA5VT	DIODE, SWITCHING	
D821	MA4047HTA	DIODE	
D822	RN1ZLF-B1	DIODE	*CT-13R32E/CE CT-13R42E/CE*
D823	**S3L60P154004**	**DIODE**	
D824	D1NL20UV70	DIODE	
D851	**RL30A**	**DIODE**	***CT-13R52DE***
D852	RL30A	DIODE	*CT-13R52DE*
D860	MA4062MTA	DIODE, ZENER	*CT-13R52DE*
D861	AS01V0	DIODE	*CT-13R52DE*
D865	ERA15-01V3	DIODE, RECTIFIER	*CT-13R52DE*
D868	AS01V0	DIODE	*CT-13R52DE*
D869	AS01V0	DIODE	*CT-13R52DE*
D2350	MA4068MTA	DIODE, ZENER	
D2351	MA165TA5VT	DIODE, SWITCHING	
D2352	MA165TA5VT	DIODE, SWITCHING	
D2353	MA165TA5VT	DIODE, SWITCHING	
D2354	MA4091MTA	DIODE	
D3001	MA3110MTX	DIODE, ZENER	
D3003	MA3110MTX	DIODE, ZENER	
D3004	MA3110MTX	DIODE, ZENER	
D3017	MA3110MTX	DIODE, ZENER	
D3018	MA3110MTX	DIODE, ZENER	
D3019	MA3110MTX	DIODE, ZENER	
D3020	MA3110MTX	DIODE, ZENER	
		FUSES	
F801	**XBA2A00101**	**FUSE 6.3A 125V**	
	XBA1F70NU100	**FUSE 7A 125V, DC Cord**	***CT-13R52DE***
		INTEGRATED CIRCUITS	
IC001	**M65580MAP101**	**IC, MPU/VCJ**	
IC002	TVR2AJ093	IC, EEPROM	
IC003	PIC-37042SR	IC, IR RECEIVER	
IC005	PQ1R33	IC, VOLTAGE REGULATOR, 3.3V	
IC006	MN1280R	IC, RESET	
IC050	TC74HC4066AL	IC, HALFTONE	
IC451	**LA7837-TV**	**IC, V-OUT**	

REPLACEMENT PARTS LIST

Models: CT-13R32E/CE, CT-13R42E/CE & CT-13R52DE

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF NO.	PART NO.	DESCRIPTION
IC551	AN78L09	IC, VOLTAGE REGULATOR, 9V
IC552	**AN78M05LB**	**IC, VOLTAGE REGULATOR, 5V**
IC553	**AN78M05LB**	**IC, VOLTAGE REGULATOR, STBY**
IC801	**STRG5623**	**IC, POWER SUPPLY**
IC851	**STK740-020**	**IC, POWER SUPPLY** ***CT-13R52DE***
IC2302	AN17800A	IC, AUDIO AMP
		COILS
LC005	EXCEMT332DT	EMI FILTER
LC007	EXCEMT332DT	EMI FILTER
LC013	EXCEMT332DT	EMI FILTER
LC018	EXCEMT332DT	EMI FILTER
L001	EXCELSA35T	FERRITE BEAD
L002	EXCELDR35V	FERRITE BEAD
L003	TLUABTA2R2K	COIL, PEAKING 2.2UH
L004	TLUABTA2R2K	COIL, PEAKING 2.2UH
L006	EXCELSA24T	FERRITE BEAD
L008	TLUABTA470K	COIL, PEAKING 47UH
L009	EXCELSA35V	FERRITE BEAD
L010	ELESN330JA	COIL, PEAKING 33UH
L011	ELESN330JA	COIL, PEAKING 33UH
L014	ELESN180KA	COIL, PEAKING 18UH
L015	EXCELSA35T	FERRITE BEAD
L016	EXCELSA35V	FERRITE BEAD
L017	TLUABTA100K	COIL, PEAKING 10UH
L018	TLUABTA150K	COIL, PEAKING 15UH
L090	EXCELSA24T	FERRITE BEAD
L104	TLUABTA2R2K	COIL, PEAKING 2.2UH
L108	EXCELSA35V	FERRITE BEAD
L351	TLTABT470K	COIL, PEAKING 47UH
L416	EXCELSA39V	FERRITE BEAD
L551	**ELH5L4136**	**COIL**
L552	EXCELSA24T	FERRITE BEAD
L553	EXCELSA24T	FERRITE BEAD
L801	**ELF15N013A**	**LINE FILTER**
L803	ELESN120JA	COIL, PEAKING 12UH
L805	EXCELSA35V	FERRITE BEAD
L851	EXCELSA39V	FERRITE BEAD *CT-13R52DE*
L852	EXCELSA39V	FERRITE BEAD *CT-13R52DE*
L860	TLT151K991K	COIL, PEAKING 150UH *CT-13R52DE*
L2350	ELESN4R7JA	COIL, PEAKING 4.7UH
		TRANSISTORS
Q001	2SD601ARTX	TRANSISTOR *CT-13R32E/CE CT-13R42E/CE*
Q002	2SD601ARTX	TRANSISTOR *CT-13R52DE*
Q006	2SB709ARTX	TRANSISTOR
Q007	2SB709ARTX	TRANSISTOR
Q008	2SB709ARTX	TRANSISTOR
Q009	2SC1473A	TRANSISTOR
Q050	2SB709ARTX	TRANSISTOR
Q051	2SB709ARTX	TRANSISTOR
Q052	2SB709ARTX	TRANSISTOR

REF NO.	PART NO.	DESCRIPTION
Q053	2SD601ARTX	TRANSISTOR
Q054	2SD601ARTX	TRANSISTOR
Q055	2SD601ARTX	TRANSISTOR
Q090	2SB709ARTX	TRANSISTOR
Q092	2SB709ARTX	TRANSISTOR
Q351	2SC1573NC	TRANSISTOR
Q352	2SC1573NC	TRANSISTOR
Q353	2SC1573NC	TRANSISTOR
Q354	2SD601ARTX	TRANSISTOR
Q355	2SD601ARTX	TRANSISTOR
Q356	2SD601ARTX	TRANSISTOR
Q451	2SD601ARTX	TRANSISTOR
Q452	2SD601ARTX	TRANSISTOR
Q453	2SD601ARTX	TRANSISTOR
Q501	2SC1573AH	TRANSISTOR
Q520	2SD601ARTX	TRANSISTOR
Q551	**2SD2499LBMA2**	**TRANSISTOR**
Q605	2SB709ARTX	TRANSISTOR
Q606	2SD601ARTX	TRANSISTOR
Q820	2SA1767QTA	TRANSISTOR
Q830	2SB1011QRL	TRANSISTOR
Q851	2SC1685QRSTA	TRANSISTOR *CT-13R52DE*
Q860	2SA564AQRSTA	TRANSISTOR *CT-13R52DE*
Q861	TF361MALF3	TRANSISTOR *CT-13R52DE*
Q2350	2SB709ARTX	TRANSISTOR
		RELAYS
RL801	**TSEH0005**	**RELAY**
		RESISTORS
R001	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R002	ERJ6GEYJ103V	RES,M 10K-J-1/10W *CT-13R52DE*
R003	ERJ6GEYJ105V	RES,M 1M-J-1/10W
R004	ERJ6GEYJ562V	RES,M 5.6K-J-1/10W *CT-13R32E/CE CT-13R42E/CE*
R006	ERDS2TJ101T	RES,C 100-J-1/4W
R007	ERJ6GEYJ471V	RES,M 470-J-1/10W
R008	ERJ6GEYJ471V	RES,M 470-J-1/10W
R009	ERJ6GEYJ472V	RES,M 4.7K-J-1/10W
R010	ERJ6GEYJ682V	RES,M 6.8K-J-1/10W
R011	ERJ6GEYJ682V	RES,M 6.8K-J-1/10W
R012	ERJ6GEYJ473V	RES,M 47K-J-1/10W
R013	ERJ6GEYJ202V	RES,M 2K-J-1/10W
R014	ERJ6GEYJ221V	RES,M 220-J-1/10W
R015	ERJ6GEYJ221V	RES,M 220-J-1/10W
R016	ERJ6GEYJ221V	RES,M 220-J-1/10W
R017	ERJ6GEYJ681V	RES,M 680-J-1/10W
R018	ERJ6GEYJ681V	RES,M 680-J-1/10W
R019	ERJ6GEYJ681V	RES,M 680-J-1/10W
R021	ERJ6GEYJ101V	RES,M 100-J-1/10W
R022	ERJ6GEYJ101V	RES,M 100-J-1/10W
R023	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R024	ERJ6GEYJ562V	RES,M 5.6K-J-1/10W

REPLACEMENT PARTS LIST

Models: CT-13R32E/CE, CT-13R42E/CE & CT-13R52DE

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REF NO.	PART NO.	DESCRIPTION
R028	ERJ6GEYJ472V	RES,M 4.7K-J-1/10W
R029	ERJ6GEYJ472V	RES,M 4.7K-J-1/10W
R032	ERJ6ENF1002V	RES,M 10K-F-1/10W
R033	ERJ6GEYJ222V	RES,M 2.2K-J-1/10W
R034	ERJ6GEYJ222V	RES,M 2.2K-J-1/10W
R035	ERJ6GEYJ332V	RES,M 3.3K-J-1/10W
R036	ERJ6GEYJ562V	RES,M 5.6K-J-1/10W
R037	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R038	ERJ6GEYJ223V	RES,M 22K-J-1/10W
R039	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R040	ERJ6GEYJ223V	RES,M 22K-J-1/10W
R041	ERJ6GEYJ153V	RES,M 15K-J-1/10W
R042	ERJ6GEYJ392V	RES,M 3.9K-J-1/10W
R043	ERJ6GEYJ912V	RES,M 9.1K-J-1/10W
R044	ERJ6GEYJ752V	RES,M 7.5K-J-1/10W
R045	ERJ6GEYJ101V	RES,M 100-J-1/10W
R046	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R048	ERJ6GEYJ562V	RES,M 5.6K-J-1/10W *CT-13R52DE*
R062	ERJ6GEYJ122V	RES,M 1.2K-J-1/10W
R063	ERJ6GEYJ122V	RES,M 1.2K-J-1/10W
R064	ERJ6GEYJ122V	RES,M 1.2K-J-1/10W
R065	ERJ6GEYJ272V	RES,M 2.7K-J-1/10W
R066	ERJ6GEYJ272V	RES,M 2.7K-J-1/10W
R067	ERJ6GEYJ272V	RES,M 2.7K-J-1/10W
R068	ERJ6GEYJ182V	RES,M 1.8K-J-1/10W
R069	ERJ6GEYJ682V	RES,M 6.8K-J-1/10W
R070	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R071	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R072	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R078	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R079	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R081	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R090	ERJ6GEYJ471V	RES,M 470-J-1/10W
R091	ERJ6GEYJ185V	RES,M 1.8MEG-J-1/10W
R092	ERJ6GEYJ473V	RES,M 47K-J-1/10W
R093	ERJ6GEYJ331V	RES,M 330-J-1/10W
R201	ERJ6GEYJ472V	RES,M 4.7K-J-1/10W
R351	ERG2FJ123H	RES,M 12K-J-2W
R352	ERG2FJ123H	RES,M 12K-J-2W
R357	ERJ6ENF6200V	RES,M 620-F-1/10W
R358	ERJ6ENF6200V	RES,M 620-F-1/10W
R359	ERJ6ENF6200V	RES,M 620-F-1/10W
R360	ERJ6ENF6200V	RES,M 620-F-1/10W
R361	ERJ6ENF6200V	RES,M 620-F-1/10W
R362	ERJ6ENF6200V	RES,M 620-F-1/10W
R363	ERJ6GEYJ101V	RES,M 100-J-1/10W
R364	ERJ6GEYJ101V	RES,M 100-J-1/10W
R365	ERJ6GEYJ101V	RES,M 100-J-1/10W
R369	ERG2FJ123H	RES,M 12K-J-2W
R374	ERDS1TJ272T	RES,C 2.7K-J-1/2W
R375	ERDS1TJ272T	RES,C 2.7K-J-1/2W

REF NO.	PART NO.	DESCRIPTION
R376	ERDS1TJ272T	RES,C 2.7K-J-1/2W
R381	ERJ6GEYJ101V	RES,M 100-J-1/10W
R382	ERJ6GEYJ101V	RES,M 100-J-1/10W
R383	ERJ6GEYJ101V	RES,M 100-J-1/10W
R384	ERJ6ENF2701V	RES,M 2.7K-F-1/10W
R385	ERJ6ENF4421V	RES,M 4.42K-F-1/10W
R386	ERJ6ENF1201V	RES,M 1.2K-F-1/10W
R387	ERJ6ENF2701V	RES,M 2.7K-F-1/10W
R388	ERJ6ENF4421V	RES,M 4.42K-F-1/10W
R389	ERJ6ENF1201V	RES,M 1.2K-F-1/10W
R390	ERJ6ENF2701V	RES,M 2.7K-F-1/10W
R391	ERJ6ENF4421V	RES,M 4.42K-F-1/10W
R392	ERJ6ENF1201V	RES,M 1.2K-F-1/10W
R451	ERDS1FJ1R8P	RES,C 1.8-J-1/2W
R454	ERJ6GEYJ473V	RES,M 47K-J-1/10W
R455	ERJ6GEYJ153V	RES,M 15K-J-1/10W
R456	ERJ6GEYJ682V	RES,M 6.8K-J-1/10W
R457	ERJ6GEYJ182V	RES,M 1.8K-J-1/10W
R458	ERJ6GEYJ223V	RES,M 22K-J-1/10W
R459	ERJ6GEYJ683V	RES,M 68K-J-1/10W
R460	ERDS2TJ102T	RES,C 1K-J-1/4W
R461	ERDS2TJ152T	RES,C 1.5K-J-1/4W
R462	ERJ6GEYJ473V	RES,M 47K-J-1/10W
R463	ERJ6GEYJ473V	RES,M 47K-J-1/10W
R465	ERJ6GEYJ183V	RES,M 18K-J-1/10W
R466	ERJ6GEYJ683V	RES,M 68K-J-1/10W
R467	ERJ6GEYJ104V	RES,M 100K-J-1/10W
R468	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R469	ERJ6GEYJ100V	RES,M 10-J-1/10W
R470	ERDS2TJ152T	RES,C 1.5K-J-1/4W
R471	ERJ6GEYJ223V	RES,M 22K-J-1/10W
R472	ERJ6GEYJ473V	RES,M 47K-J-1/10W
R475	ERJ6GEYJ471V	RES,M 470-J-1/10W
R502	ERJ6GEYJ562V	RES,M 5.6K-J-1/10W
R504	ERDS2TJ152T	RES,C 1.5K-J-1/4W
R505	ERJ6GEYJ222V	RES,M 2.2K-J-1/10W
R506	ERJ6GEYJ333V	RES,M 33K-J-1/10W
R507	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R508	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R510	**ERG3FJ322H**	**RES,M 3.3K-J-3W**
R512	ERG2FJ562H	RES,M 5.6K-J-2W
R520	ERJ6GEYJ471V	RES,M 470-J-1/10W
R521	ERJ6GEYJ272V	RES,M 2.7K-J-1/10W
R531	**ERD25FJ470P**	**RES,C 47-J-1/4W**
R532	**ERJ6ENF1002V**	**RES,M 10K-F-1/10W**
R533	**ERJ6ENF1691V**	**RES,M 1.69K-F-1/10W**
R551	**ERDS1FJ1R0T**	**RES,C 1.0-J-1/2W**
R552	**ERDS1FJ1R0T**	**RES,C 1.0-J-1/2W**
R553	ERDS1FJ1R0T	RES,C 1.0-J-1/2W *CT-13R52DE*
R555	**ERDS1FJ101T**	**RES,C 100-J-1/2W**
R556	ERG1SJ221P	RES,M 220-J-1W

REPLACEMENT PARTS LIST

Models: CT-13R32E/CE, CT-13R42E/CE & CT-13R52DE

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REF NO.	PART NO.	DESCRIPTION
R557	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R558	**ERQ1CJP1R5S**	**RES,F 1.5-J-1W**
R559	ERG2FJ683H	RES,M 12K-J-2W
R560	ERDS1FJ182P	RES,C 1.8K-J-1/2W
R562	ERG3FJ680H	RES,M 68-J-3W
R563	ERG1SJ150P	RES,M 15-J-1W
R567	ERG2FJ471H	RES,M 470-J-2W
R572	ERJ6GEYJ392V	RES,M 3.9K-J-1/10W
R605	ERDS2TJ103T	RES,C 10K-J-1/4W
R606	ERJ6GEYJ562V	RES,M 5.6K-J-1/10W
R607	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R608	ERJ6GEYJ104V	RES,M 100K-J-1/10W
R801	**ERF7ZK1R5**	**RES,W 1.5-K-7W**
R802	ERDS2TJ684T	RES,C 680K-J-1/4W
R803	ERG2FJ100H	RES,M 10K-J-1/2W
R804	ERG2FJ104H	RES,M 100K-J-1/2W
R805	**ERX2FJR27H**	**RES,C .27-J-2W**
R807	ERDS2TJ681T	RES,C 680-J-1/4W
R808	ERDS2TJ4R7T	RES,C 4.7-J-1/4W
R809	ERDS2TJ472T	RES,C 4.7K-J-1/4
R815	**ERC12ZGM825D**	**RES,S 8.2MEG-M-1/2**
R817	**ERX3FJ4R7**	**RES,M 4.7-J-3W**
R821	ERDS1FJ1R0T	RES,C 1.0-J-1/2W
R823	ERDS1FJ272T	RES,C 2.7K-J-1/2W
R824	ERDS2TJ223T	RES,C 22K-J-1/4W
R825	ERDS2TJ272T	RES,C 2.7K-J-1/4W
R828	ERJ6GEYJ104V	RES,M 100K-J-1/10W
R830	ERDS2TJ104T	RES,C 100K-J-1/4W
R831	ERDS2TJ682T	RES,C 6.8K-J-1/4W
R850	**ERQ12HJR56P**	**RES,F .56-J-1/2W** ***CT-13R32E/CE CT-13R42E/CE***
R854	**ER0S2TKF1003**	**RES,M 100K-F-1/4** ***CT-13R52DE***
R855	**EVND2AA03B24**	**CONTROL 20K** ***CT-13R52DE***
R856	**ER0S2TKF4300**	**RES,M 430-F-1/4W** ***CT-13R52DE***
R857	**ERF5ZJ681**	**RES,W 680-J-5W** ***CT-13R52DE***
R858	ERG1SJ272P	RES,M 2.7K-J-1W *CT-13R52DE*
R860	ERDS2TJ152T	RES,C 1.5K-J-1/4W *CT-13R52DE*
R861	ERDS2TJ103T	RES,C 10K-J-1/4W *CT-13R52DE*
R862	ERDS2TJ272T	RES,C 2.7K-J-1/4W *CT-13R52DE*
R863	ERDS2TJ471T	RES,C 470-J-1/4W *CT-13R52DE*
R864	ERDS2TJ102T	RES,C 1K-J-1/4W *CT-13R52DE*
R865	ERDS1TJ105T	RES,C 1MEG-J-1/2W *CT-13R52DE*
R867	ERD25FJ150P	RES,C 15-J-1/4W *CT-13R52DE*
R869	ERDS2TJ224T	RES,C 220K-J-1/4W *CT-13R52DE*
R870	ERDS2TJ564T	RES,C 560K-J-1/4W *CT-13R52DE*
R875	ERDS2TJ103T	RES,C 10K-J-1/4W *CT-13R52DE*
R876	ERDS2TJ103T	RES,C 10K-J-1/4W *CT-13R52DE*
R877	ERDS2TJ272T	RES,C 2.7K-J-1/4W *CT-13R52DE*
R878	ERDS2TJ152T	RES,C 1.5K-J-1/4W *CT-13R52DE*
R2301	ERQ2CJP3R9S	RES,F 3.9-J-2W
R2307	ERJ6GEYJ103V	RES,M 10K-J-1/10W

REF NO.	PART NO.	DESCRIPTION
R2325	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R2350	ERDS2TJ102T	RES,C 1K-J-1/4W
R2351	ERJ6GEYJ273V	RES,M 27K-J-1/10W
R2354	ERJ6GEYJ123V	RES,M 12K-J-1/10W
R2355	ERJ6GEYJ392V	RES,M 3.9K-J-1/10W
R2356	ERJ6GEYJ101V	RES,M 100-J-1/10W
R2357	ERJ6GEYJ472V	RES,M 4.7K-J-1/10W
R2365	ERDS2TJ102T	RES,C 1K-J-1/4W
R2370	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R3001	ERDS2TJ101T	RES,C 100-J-1/4W
R3008	ERJ6GEYJ151V	RES,M 150-J-1/10W
R3009	ERJ6GEYJ682V	RES,M 6.8K-J-1/10W
R3010	ERJ6GEYJ334V	RES,M 330K-J-1/10W
R3017	ERDS2TJ181T	RES,C 180-J-1/4W
R3018	ERJ6GEYJ682V	RES,M 6.8K-J-1/10W
		SWITCHES
S001	EVQPF106K	SWITCH
S002	EVQPF106K	SWITCH
S003	EVQPF106K	SWITCH
S004	EVQPF106K	SWITCH
S005	EVQPF106K	SWITCH
S008	EVQPF106K	SWITCH
S009	EVQPF106K	SWITCH
		TRANSFORMERS
T501	TLH15452	TRANSFORMER, HORIZONTAL DRIVER
T551	**KFT2AB118F**	**TRANSFORMER, FLYBACK**
T801	**ETS29AS183NC**	**TRANSFORMER**
T852	**ETS29AK1X9NC**	**TRANSFORMER** ***CT-13R52DE***
		CRYSTALS/FILTERS
X001	TSSA092	CRYSTAL OSCILLATOR
X002	AF080005BE	CRYSTAL OSCILLATOR
		OTHERS
TNR001	**ENG36610G**	**TUNER**
M001	EUR501455	REMOTE CONTROL *CT-13R32E/CE CT-13R52DE*
M002	EUR501456	REMOTE CONTROL *CT-13R42E/CE*
M003	TNQ2AE013	REMOTE, MAGNETIC *CT-13R42E/CE*
M004	UR50EC1190A	BATTERY COVER, REMOTE CONTROL *CT-13R32E/CE CT-13R52DE*
M005	UR50EC1190B	BATTERY COVER, REMOTE CONTROL *CT-13R42E/CE*
M006	**TSX2AA0131**	**LINE CORD (SPT2)** ***CT-13R32E/CE CT-13R42E/CE***
M007	**TSX2AA0181**	**LINE CORD, AC** ***CT-13R52DE***
M008	**TXASX0119AAS**	**ASSY, LINE CORD DC** Connector, Line Cord, Fuse PN XBA1F70NU100 (7A 125V), Clamp, Labels ***CT-13R52DE***
M009	TMW2A97121	STRAIN RELIEF: AC LINE CORD *CT-13R32E/CE*
M010	**37GDA85X(M)**	**CRT 13"**
M011	**TJSC00200**	**SOCKET, CRT**

REPLACEMENT PARTS LIST

Models: CT-13R32E/CE, CT-13R42E/CE & CT-13R52DE

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF NO.	PART NO.	DESCRIPTION
DY	**0LY15311F**	**YOKE, DEFLECTION**
M012	JH225U-012	YOKE, CONVERGENCE
DEG	**TSP2AA010**	**COIL, DEGAUSSING 13"** ***CT-13R32E/CE CT-13R42E/CE***
DEG	**0LK19031-1A**	**COIL, DEGAUSSING 13"** ***CT-13R52DE***
M013	TXF3A01TLR2	ASSY., DAG GND
M014	TMM2A30702	WEDGE, YOKE
M015	0FMK014ZZ	CONVERGENCE CORRECTOR STRIP
M016	TXFKY09ASER	ASSY, CABINET FRONT Badge Panasonic, Guide IR, Cab. Front 13", Smoked Sheet *CT-13R42E/CE*
M017	TXFKY20ESER	ASSY, CABINET FRONT Badge Panasonic, Guide IR, Cab. Front 13", Smoked Sheet *CT-13R32E/CE*
M018	TXFKY21ESER	ASSY, CABINET FRONT Badge Panasonic, Guide IR, Cab. Front 13", Smoked Sheet *CT-13R52DE*
M019	TXFKU02BSER	ASSY, CABINET BACK Labels, Nameplate, Felt, Cab. Back 13" *CT-13R32E/CE*
M020	TXFKU14ESER	ASSY, CABINET BACK Labels, Nameplate, Felt, Cab. Back 13" *CT-13R42E/CE*
M021	TXFKU2397SER	ASSY, CABINET BACK Labels, Nameplate, Felt, Cab. Back 13" *CT-13R52DE*
M022	TKP2AA00601	SMOKED SHEET
M023	TKX2A3751	GUIDE, IR
M024	TAS2AA0014	SPEAKER 16-OHM 1.5W
M025	TBX2AA00701G	BUTTON, 7-KEY *CT-13R32E/CE CT-13R52DE*
M026	TBX2AA00702G	BUTTON, 7-KEY *CT-13R42E/CE*
M027	TBM2A30832	BADGE, PANASONIC
M028	TJB2A20701	ANTENNA CONVERTER 75-300
M029	TSA2AA0001	ANTENNA, DIPOLE
JK3001	TJB2A9061B	BRACKET, A/V
JK3002	TJB2AA0048	TERMINAL, FRONT A/V
M030	TQB2AA0388	MANUAL, OWNERS *CT-13R32E CT-13R42E*
M031	TQB2AA0396	MANUAL, OWNERS *CT-13R32CE CT-13R42CE CT-13R52DE*
M032	TQB2AA7095	REMOTE CONTROL GUIDE
M032	TQB2AA7108	V-CHIP MANUAL

DESCRIPTION OF ABBREVIATIONS GUIDE

RESISTOR

TYPE		TOLERANCE	
C	Carbon	F	± 1%
F	Fuse	J	± 5%
M	Metal Oxide	K	± 10%
S	Solid	M	± 20%
W	Wire Wound	G	± 2%

RES, C 270-J-1/4

CAPACITOR

TYPE		TOLERANCE	
C	Ceramic	C	± 0.25pF
E	Electrolytic	D	± 0.5pF
P	Polyester	F	± 1pF
S	Styrol	J	± 5%
T	Tantalum	K	± 10%
		L	± 15%
		M	± 20%
		P	+10% -0%
		Z	+80% -20%

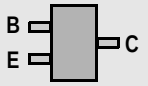
CAP, P .068UF-K-50V

Schematic Notes

IMPORTANT SAFETY NOTICE

THIS SCHEMATIC DIAGRAM INCORPORATES SPECIAL FEATURES THAT ARE IMPORTANT FOR PROTECTION FROM X-RADIATION, FIRE AND ELECTRICAL SHOCK HAZARDS. WHEN SERVICING IT IS ESSENTIAL THAT ONLY MANUFACTURERS SPECIFIED PARTS BE USED FOR THE CRITICAL COMPONENTS DESIGNATED WITH A ⚠ IN THE SCHEMATIC.

CHIP TRANSISTOR LEAD DESIGNATION



SCHEMATIC NOTES

1. Resistors are carbon 1/4W unless noted otherwise.
2. Capacitors are ceramic 50V unless noted otherwise.
3. Coil value notes is inductance in µH.
4. Test point indicated by ; Test point but no pin .
5. Components indicated with ⚠ are critical parts and replacement should be made with manufacture specified replacement parts only.
6. ▬▬ (**BOLD LINE**) indicates the route of B+ supply.
7. The schematic diagrams are current at the time of printing and are subject to change without notice.
8. Ground symbol ⏚ indicates **HOT GROUND CONNECTION**; ⏚ indicates COLD GROUND.

NOTE: All other component symbols are used for engineering design purposes.

VOLTAGE MEASUREMENTS

1. Voltage measurement:
   - AC input to the Receiver is 120V. NTSC (HD, 1125i & 525P when applicable) signal generator is connected to the antenna of the Receiver. (Color bar pattern of 100 IRE white and 7.5 IRE black.)
   - All Picture and Audio adjustments are set to Normalize.
     TV ANT/CABLE - (Set-Up Menu) in TV/ANT Mode
     Volume - Min.
     TV/Video SW - TV position
     Audio Mode - Stereo
   - Voltage readings are nominal and may vary ±10% on active devices. Some voltage reading will vary with signal strength and picture content.
   - Supply voltages are nominal.
2. Ground symbol ⏚ indicates ground lead connection of meter.
   Incorrect ground connection will result in erroneous readings.

CAUTION: ***Incorrect ground connection of the test equipment will result in erroneous readings.***

WAVEFORM MEASUREMENTS

1. ③ indicates waveform measurement. (Measurement can be taken at the best accessible location in common to the indicated point.)
2. Taken with an NTSC signal generator connected to the antenna terminal. (NTSC color bar pattern of 8 bars of EIA colors, 100 IRE white and 7.5 IRE black.)
3. Customer Controls (Picture/Audio Menu) are set to Normalize. Volume is set to “MIN”.
4. All video and color waveforms are taken with a wideband scope and a probe with low capacitance (10 to 1). Shape and peak altitudes may vary depending on the type of Oscilloscope used and its settings.
5. Ground symbol ⏚ shown on waveform number indicates (Hot) ground lead connection of the Oscilloscope.

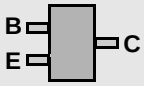
CAUTION: Incorrect ground connection of the test equipment will result in erroneous readings.

Schematic Notes

NOTA DE SEGURIDAD

LOS DIAGRAMAS ELÉCTRICOS INCLUYEN CARACTERÍSTICAS ESPECIALES MUY IMPORTANTES PARA LA PROTECCIÓN CONTRA RAYOS-X, QUEMADURAS Y DESCARGAS ELÉCTRICAS. CUANDO SE DE SERVICIO ES IMPORTANTE USAR PARA REEMPLAZO DE COMPONENTES CRITICOS, SOLO PARTES ESPECIFICADAS POR EL FABRICANTES. LOS COMPONENTES CRITICOS ESTAN SEÑALADOS EN LOS DIAGRAMAS POR EL SIMBOLO ⚠.

IDENTIFICACIÓN DE TERMINALES PARA TRANSISTORES EN *CHIP*



NOTAS DE LOS DIAGRAMAS

1. Las Resistencias son de Carbón de 1/4W, a menos que se indique otra característica.
2. Los Capacitores son de Cerámica para 50V, a menos que se indique otra característica.
3. El valor indicado de las Bobinas es la inductancia expresada en µH.
4. Los puntos de prueba en la terminal de algún componente son indicados por ● Los puntos de prueba fuera de los componentes se indican con ○.
5. Los componentes señalados con el símbolo ⚠ son considerados componentes críticos y deben ser reemplazados sólo con las partes especificadas por el fabricante.
6. ▬ (**LINEA GRUESA**) indica las líneas de alimentación de los Voltajes B+.
7. Los diagramas eléctricos están sujetos a cambio sin previo aviso.
8. El símbolo ⏚ indica que es una conexión a **Tierra Caliente** y el símbolo ⏚ indica conexión a **Tierra Fría**.

NOTA: Los demas símbolos de componentes incluidos son usados con fines de diseño.

MEDICIÓN DE VOLTAJES

1. Medición de voltaje:
   - El voltaje de entrada al Receptor es de 120V de Corriente Alterna. Un generador de patrones con formato NTSC se conecta a la entrada de la antena. (Patrón de Barras de Colores con 100 IREs para el Blanco y 7.5 IREs para el Negro.)
   - Los ajustes de los Menus Picture y Audio se normalizan.
     En el Menú Set-Up, en la opción ANTENA, se selecciona el modo de CABLE.
     El nivel de Volumen se minimiza.
     De los modos TV y Video, seleccionar el modo TV.
     Seleccionar modo Estereo del Audio.
   - Las mediciones de los voltajes son nominales y pueden variar hasta 10% en componentes en funcionamiento. Las lecturas de los voltajes pueden variar por la potencia de la señal y el contenido de la imagen.
   - Las fuentes de voltajes son nominales.
2. El símbolo ⏚ indica el tipo de tierra que se utiliza en la conexión del medidor.

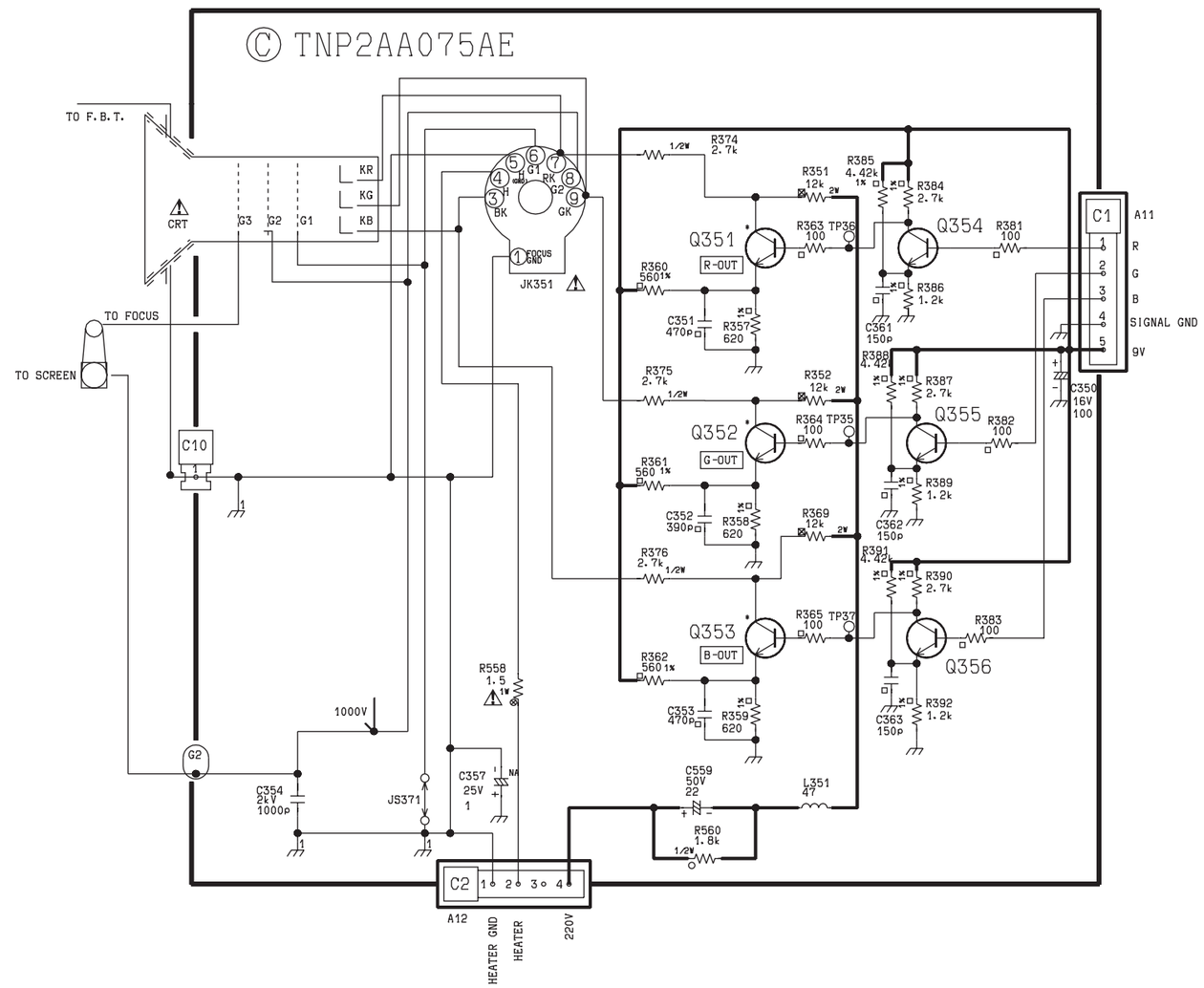
PRECAUCION: SI no se utiliza la conexión a la tierra adecuada, se obtendrán mediciones equivocadas y podría dañar el equipo de medición.

MEDICIÓN DE FORMAS DE ONDA

1. Un símbolo como ③ indica el punto para medir una señal. (La medición puede hacerse en el punto con mayor accesibilidad, siempre que sea común al indicado.)
2. Se midieron utilizando un generador con formato NTSC conectado a la terminal de la antena. (Patrón de 8 Barras de Colores EAI, formato NTSC de 100 IREs para el Blanco y 7.5 IREs para el Negro.)
3. Los ajustes de usuario de los Menus PICTURE y AUDIO se normalizaron. Posteriormente el nivel de volumen se ajusta al mínimo.
4. Las formas de onda de Video y Color fueron tomadas con un osciloscopio de banda alta y con un punta de prueba de baja capacitancia (10 a 1). La forma y amplitud de las ondas puede variar según el tipo de osciloscopio que se utilice y sus características.
5. El símbolo de tierra ⏚ que aparece junto al número de la forma de onda, indica que se utiliza conexión a **Tierra Caliente** en el extremo negativo de la punta de prueba.

PRECAUCION: Si no se utiliza la conexión a la tierra adecuada, se obtendrán mediciones equivocadas y podría dañar el equipo de medición.

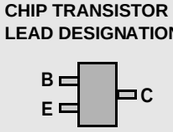
C-BOARD -- TARJETA C
ALL MODELS -- TODOS LOS MODELOS



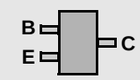
Notes:

- Check Parts List for most recent component values and part numbers.
- Obtain voltages with a digital multimeter.
- The board layouts were modified to enhance and display traces otherwise hidden by a mask.

CHIP TRANSISTOR LEAD DESIGNATION



IDENTIFICACIÓN DE TERMINALES PARA TRANSISTORES EN *CHIP*



	Q351	Q352	Q353
B	6.53	6.39	6.34
C	124.30	129.70	130.50
E	5.99	5.86	5.82

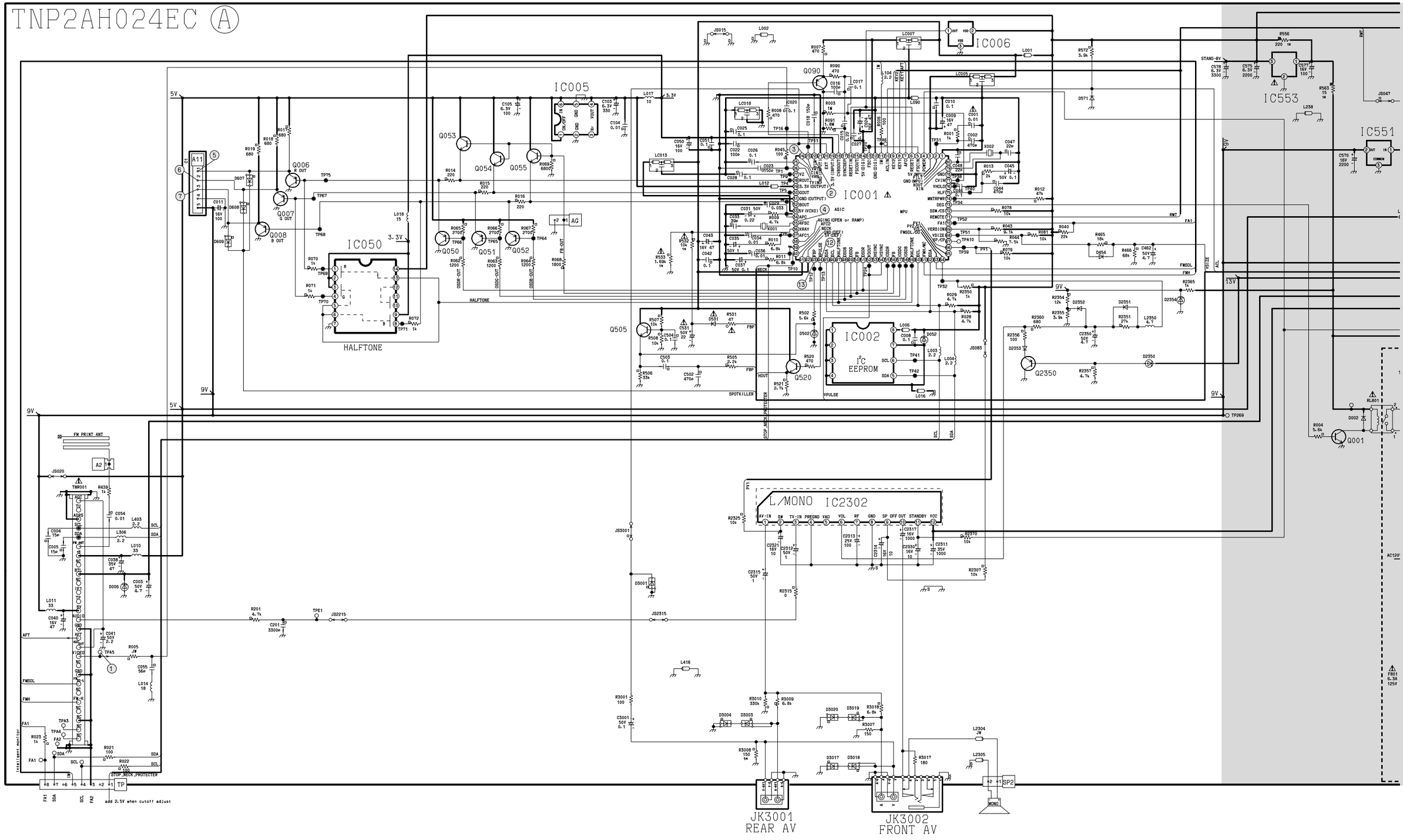
	Q354	Q355	Q356
B	3.90	3.57	3.48
C	6.54	6.50	6.33
E	2.87	2.94	2.90

Notas:

- Verifique los números de parte de los componentes y sus valores en la lista de partes.
- La medición de los voltajes se hizo con un Voltímetro Digital.

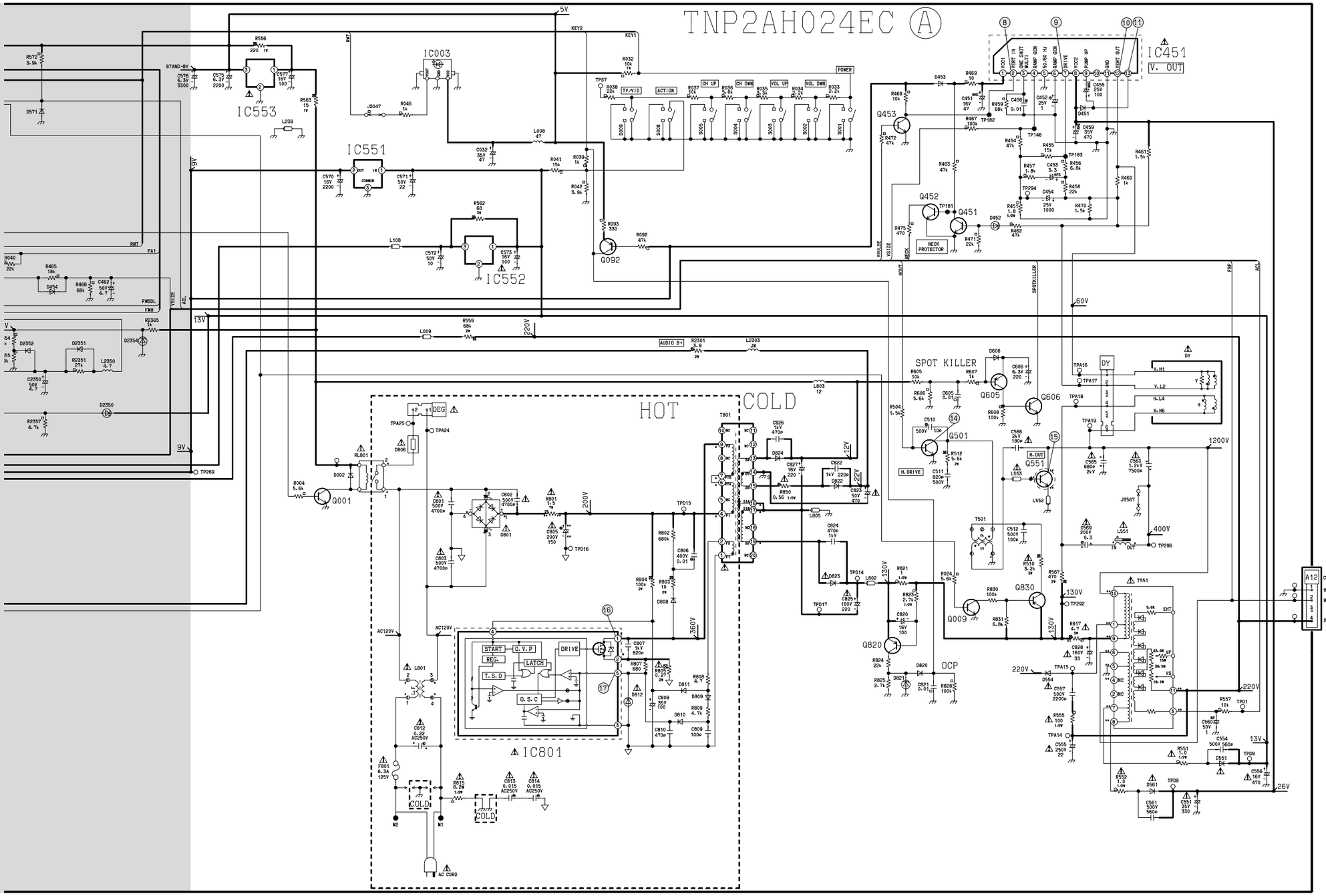
A-BOARD -- TARJETA A
CT-13R32E/CE & CT-13R42E/CE

A-BOARD SCHEMATIC LEFT PORTION -- DIAGRAMA ELÉCTRICO TARJETA A SECCIÓN IZQUIERDA



A-BOARD SCHEMATIC RIGHT PORTION -- DIAGRAMA ELÉCTRICO TARJETA A SECCIÓN DERECHA

A-BOARD -- TARJETA A
CT-13R32E/CE & CT-13R42E/CE



CHIP TRANSISTOR LEAD DESIGNATION

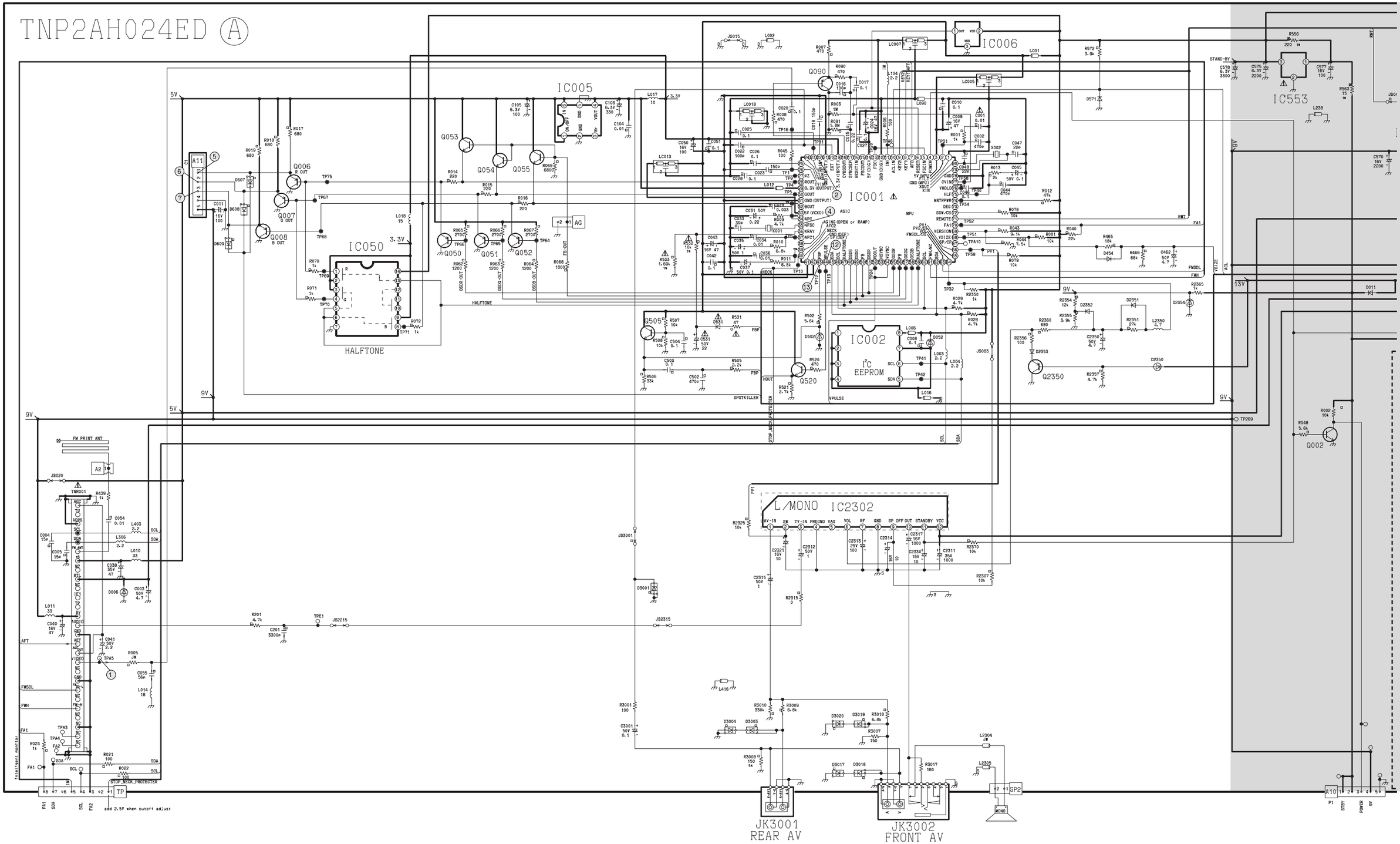
B
E
C

IDENTIFICACIÓN DE TERMINALES PARA TRANSISTORES EN *CHIP*

B
E
C

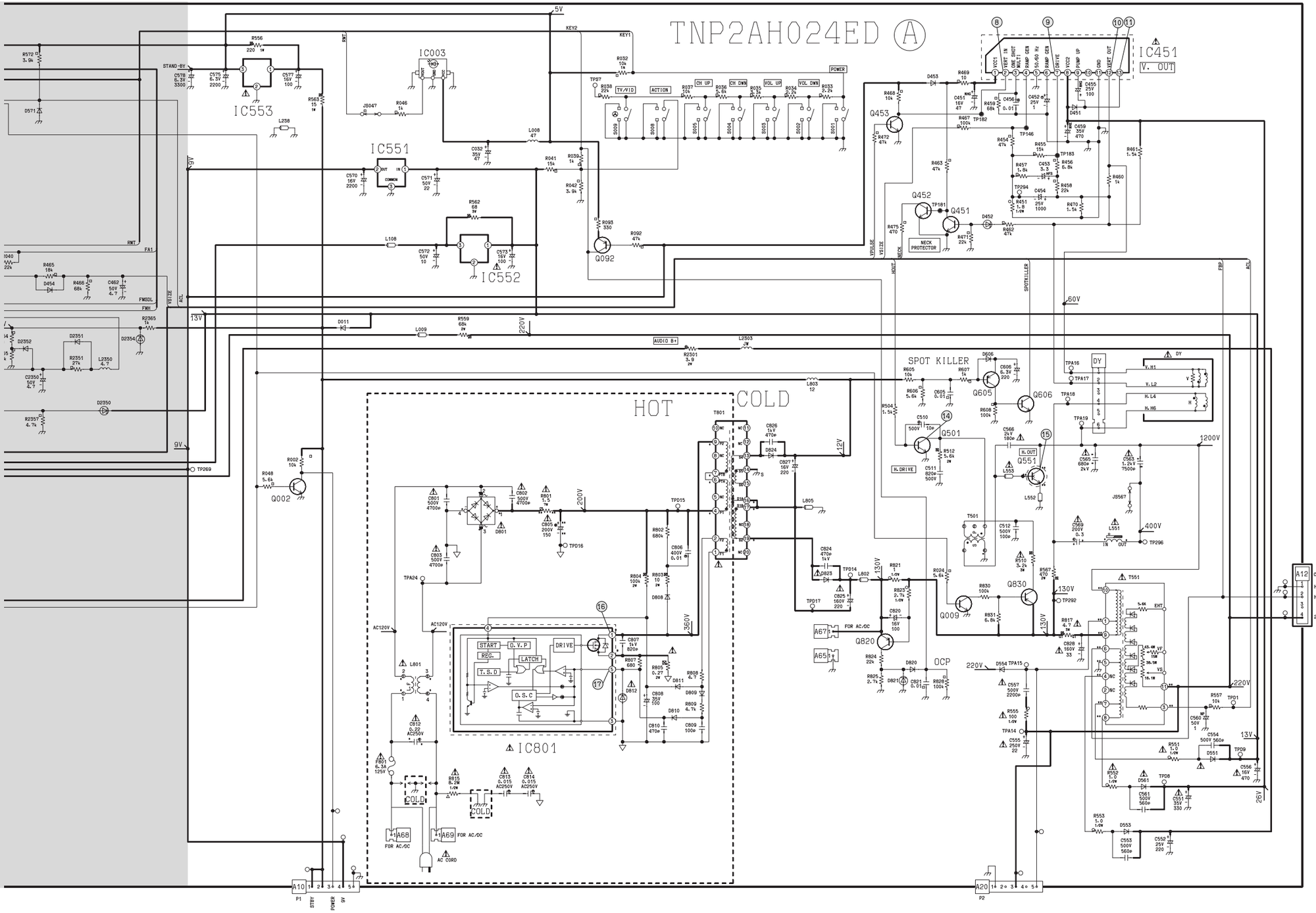
A-BOARD - TARJETA A
CT-13R52DE

A-BOARD SCHEMATIC LEFT PORTION -- DIAGRAMA ELÉCTRICO TARJETA A SECCIÓN IZQUIERDA

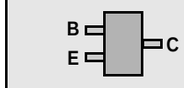


A-BOARD SCHEMATIC RIGHT PORTION -- DIAGRAMA ELÉCTRICO TARJETA A SECCIÓN DERECHA

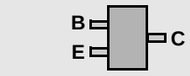
A-BOARD -- TARJETA A
CT-13R52DE



CHIP TRANSISTOR LEAD DESIGNATION



IDENTIFICACIÓN DE TERMINALES PARA TRANSISTORES EN *CHIP*



A-BOARD -- TARJETA A
ALL MODELS -- TODOS LOS MODELOS

A-BOARD VOLTAGES -- VOLTAJES TARJETA A

IC001

1	GND	41	GND
2	1.39	42	4.97
3	4.98	43	2.32
4	4.91	44	1.76
5	2.47	45	4.46
6	4.95	46	4.20
7	2.43	47	0.00
8	4.99	48	4.96
9	2.36	49	4.96
10	2.90	50	0.00
11	4.95	51	4.97
12	GND	52	0.17
13	2.47	53	n.c
14	4.97	54	0.17
15	n.c	55	4.97
16	4.98	56	0.00
17	2.93	57	4.97
18	1.35	58	4.97
19	3.21	59	0.00
20	0.52	60	4.16
21	GND	61	0.00
22	0.62	62	4.45
23	1.69	63	0.00
24	n.c	64	0.39
25	0.45	65	0.00
26	0.95	66	0.00
27	2.06	67	0.00
28	2.59	68	1.94
29	3.26	69	4.98
30	2.69	70	4.98
31	GND	71	4.97
32	2.67	72	4.98
33	4.98	73	0.00
34	2.85	74	4.96
35	2.68	75	1.95
36	2.37	76	0.18
37	2.41	77	2.16
38	n.c	78	GND
39	2.71	79	2.28
40	2.49	80	2.40

IC002

1	GND
2	GND
3	GND
4	GND
5	4.40
6	4.15
7	GND
8	4.99

IC003

1	4.97
2	GND
3	4.98

IC005

1	5.01
2	GND
3	n.c
4	3.26
5	GND
6	5.01

IC006

1	5.00
2	4.98
3	GND

IC050

1	2.59
2	3.20
3	3.21
4	2.69
5	0.00
6	0.00
7	GND
8	2.67
9	3.21
10	n.c
11	n.c
12	n.c
13	0.00
14	4.99

IC451

1	8.18
2	8.66
3	4.10
4	4.15
5	GND
6	3.92
7	3.99
8	24.32
9	1.79
10	n.c
11	GND
12	14.01
13	24.67

IC551

1	12.00
2	8.95
3	GND

IC552

1	12.01
2	GND
3	5.01

IC553

1	8.96
2	GND
3	8.91

IC801

1	187.00
2	0.00
3	GND
4	29.90
5	3.00

IC2302

1	13.58
2	0.00
3	13.62
4	GND
5	n.c
6	2.69
7	16.65
8	GND
9	4.97
10	8.80
11	3.55
12	18.73

	Q001	Q006	Q007	Q008	Q009	Q050	Q051	Q052
B	0.00	2.59	2.68	2.65	0.59	4.98	4.97	4.98
C	11.00	GND	GND	GND	0.00	GND	GND	GND
E	GND	3.24	3.33	3.31	GND	2.59	2.69	2.67

	Q053	Q054	Q055	Q090	Q092	Q451	Q452	Q453
B	0.00	0.00	0.00	1.31	8.92	0.60	0.00	0.00
C	5.00	5.01	5.01	GND	2.37	0.00	2.49	8.66
E	2.59	2.68	2.65	2.04	4.99	GND	GND	GND

	Q501	Q505	Q520	Q551	Q605	Q606	Q820	Q830	Q2350
B	0.36	2.46	1.76	0.00	4.05	0.00	130.30	129.80	6.79
C	85.20	4.98	4.98	-25.30	0.00	3.68	0.00	127.80	GND
E	GND	2.32	1.60	GND	4.01	GND	130.70	130.40	2.35

A-BOARD -- TARJETA A
ALL MODELS -- TODOS LOS MODELOS

A-BOARD VOLTAGES -- VOLTAJES TARJETA A

IC001

1	GND	41	GND
2	1.39	42	4.97
3	4.98	43	2.32
4	4.91	44	1.76
5	2.47	45	4.46
6	4.95	46	4.20
7	2.43	47	0.00
8	4.99	48	4.96
9	2.36	49	4.96
10	2.90	50	0.00
11	4.95	51	4.97
12	GND	52	0.17
13	2.47	53	n.c
14	4.97	54	0.17
15	n.c	55	4.97
16	4.98	56	0.00
17	2.93	57	4.97
18	1.35	58	4.97
19	3.21	59	0.00
20	0.52	60	4.16
21	GND	61	0.00
22	0.62	62	4.45
23	1.69	63	0.00
24	n.c	64	0.39
25	0.45	65	0.00
26	0.95	66	0.00
27	2.06	67	0.00
28	2.59	68	1.94
29	3.26	69	4.98
30	2.69	70	4.98
31	GND	71	4.97
32	2.67	72	4.98
33	4.98	73	0.00
34	2.85	74	4.96
35	2.68	75	1.95
36	2.37	76	0.18
37	2.41	77	2.16
38	n.c	78	GND
39	2.71	79	2.28
40	2.49	80	2.40

IC002

1	GND
2	GND
3	GND
4	GND
5	4.40
6	4.15
7	GND
8	4.99

IC003

1	4.97
2	GND
3	4.98

IC005

1	5.01
2	GND
3	n.c
4	3.26
5	GND
6	5.01

IC006

1	5.00
2	4.98
3	GND

IC050

1	2.59
2	3.20
3	3.21
4	2.69
5	0.00
6	0.00
7	GND
8	2.67
9	3.21
10	n.c
11	n.c
12	n.c
13	0.00
14	4.99

IC451

1	8.18
2	8.66
3	4.10
4	4.15
5	GND
6	3.92
7	3.99
8	24.32
9	1.79
10	n.c
11	GND
12	14.01
13	24.67

IC551

1	12.00
2	8.95
3	GND

IC552

1	12.01
2	GND
3	5.01

IC553

1	8.96
2	GND
3	8.91

IC801

1	187.00
2	0.00
3	GND
4	29.90
5	3.00

IC2302

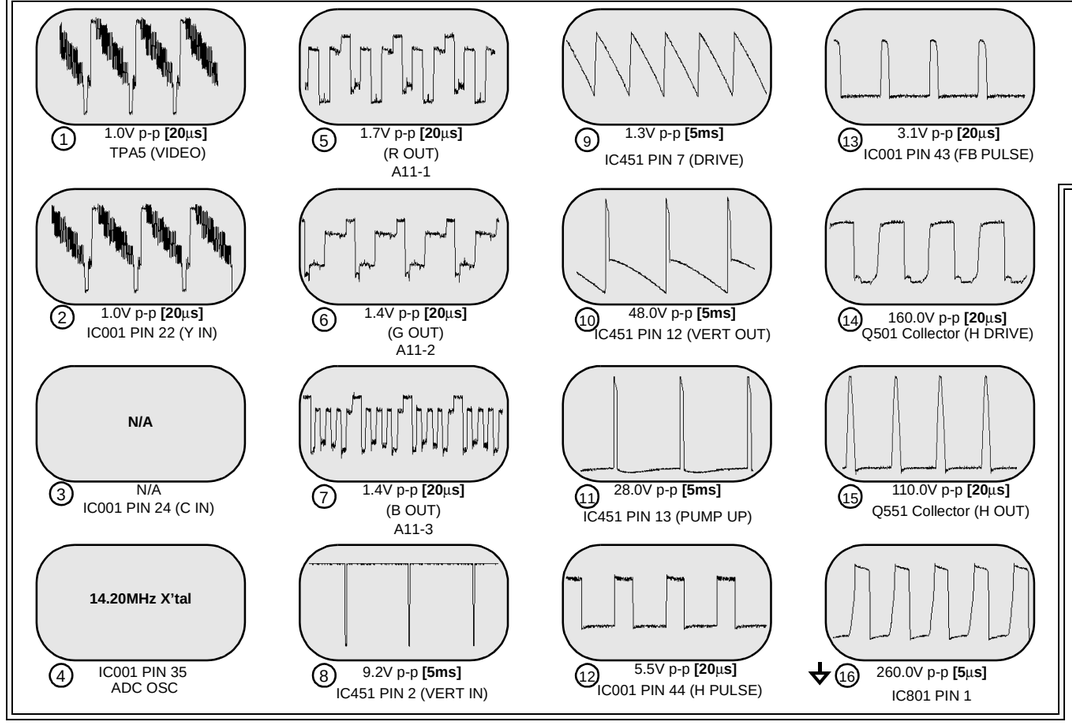
1	13.58
2	0.00
3	13.62
4	GND
5	n.c
6	2.69
7	16.65
8	GND
9	4.97
10	8.80
11	3.55
12	18.73

	Q001	Q006	Q007	Q008	Q009	Q050	Q051	Q052
B	0.00	2.59	2.68	2.65	0.59	4.98	4.97	4.98
C	11.00	GND	GND	GND	0.00	GND	GND	GND
E	GND	3.24	3.33	3.31	GND	2.59	2.69	2.67

	Q053	Q054	Q055	Q090	Q092	Q451	Q452	Q453
B	0.00	0.00	0.00	1.31	8.92	0.60	0.00	0.00
C	5.00	5.01	5.01	GND	2.37	0.00	2.49	8.66
E	2.59	2.68	2.65	2.04	4.99	GND	GND	GND

	Q501	Q505	Q520	Q551	Q605	Q606	Q820	Q830	Q2350
B	0.36	2.46	1.76	0.00	4.05	0.00	130.30	129.80	6.79
C	85.20	4.98	4.98	-25.30	0.00	3.68	0.00	127.80	GND
E	GND	2.32	1.60	GND	4.01	GND	130.70	130.40	2.35

A-BOARD WAVEFORMS -- FORMAS DE ONDA TARJETA A



Medición de Formas de Onda

1. Un símbolo como (3) indica el punto para medir una señal. (La medición puede hacerse en el punto con mayor accesibilidad, siempre que sea común al indicado.)
2. Se midieron utilizando un generador con formato NTSC conectado a la terminal de la antena. (Patrón de 8 Barras de Colores EAI, formato NTSC de 100 IREs para el Blanco y 7.5 IREs para el Negro.)
3. Los ajustes de usuario de los Menus PICTURE y AUDIO se normalizaron. Posteriormente el nivel de volumen se ajusta al mínimo.
4. Las formas de onda de Video y Color fueron tomadas con un osciloscopio de banda alta y con un punta de prueba de baja capacitancia (10 a 1). La forma y amplitud de las ondas puede variar según el tipo de osciloscopio que se utilice y sus características.
5. El símbolo de tierra ⏚ que aparece junto al número de la forma de onda, indica que se utiliza conexión a **Tierra Caliente** en el extremo negativo de la punta de prueba.

PRECAUCION: Si no se utiliza la conexión a la tierra adecuada, se obtendrán mediciones equivocadas y podría dañar el equipo de medición.

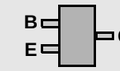
Waveform Measurements

1. (3) indicates waveform measurement. (Measurement can be taken at the best accessible location in common to the indicated point.)
2. Taken with an NTSC signal generator connected to the antenna terminal. (NTSC color bar pattern of 8 bars of EIA colors, 100 IRE white and 7.5 IRE black.)
3. Customer Controls (Picture/Audio Menu) are set to Normalize. Volume is set to "MIN".
4. All video and color waveforms are taken with a wideband scope and a probe with low capacitance (10 to 1). Shape and peak altitudes may vary depending on the type of Oscilloscope used and its settings.
5. Ground symbol ⏚ shown on waveform number indicates (Hot) ground lead connection of the Oscilloscope.

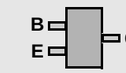
CAUTION: Incorrect ground connection of the test equipment will result in erroneous readings.

WAVEFORMS -- FORMAS DE ONDA
ALL MODELS - TODOS LOS MODELOS

CHIP TRANSISTOR LEAD DESIGNATION



IDENTIFICACIÓN DE TERMINALES PARA TRANSISTORES EN *CHIP*



NOTA DE SEGURIDAD

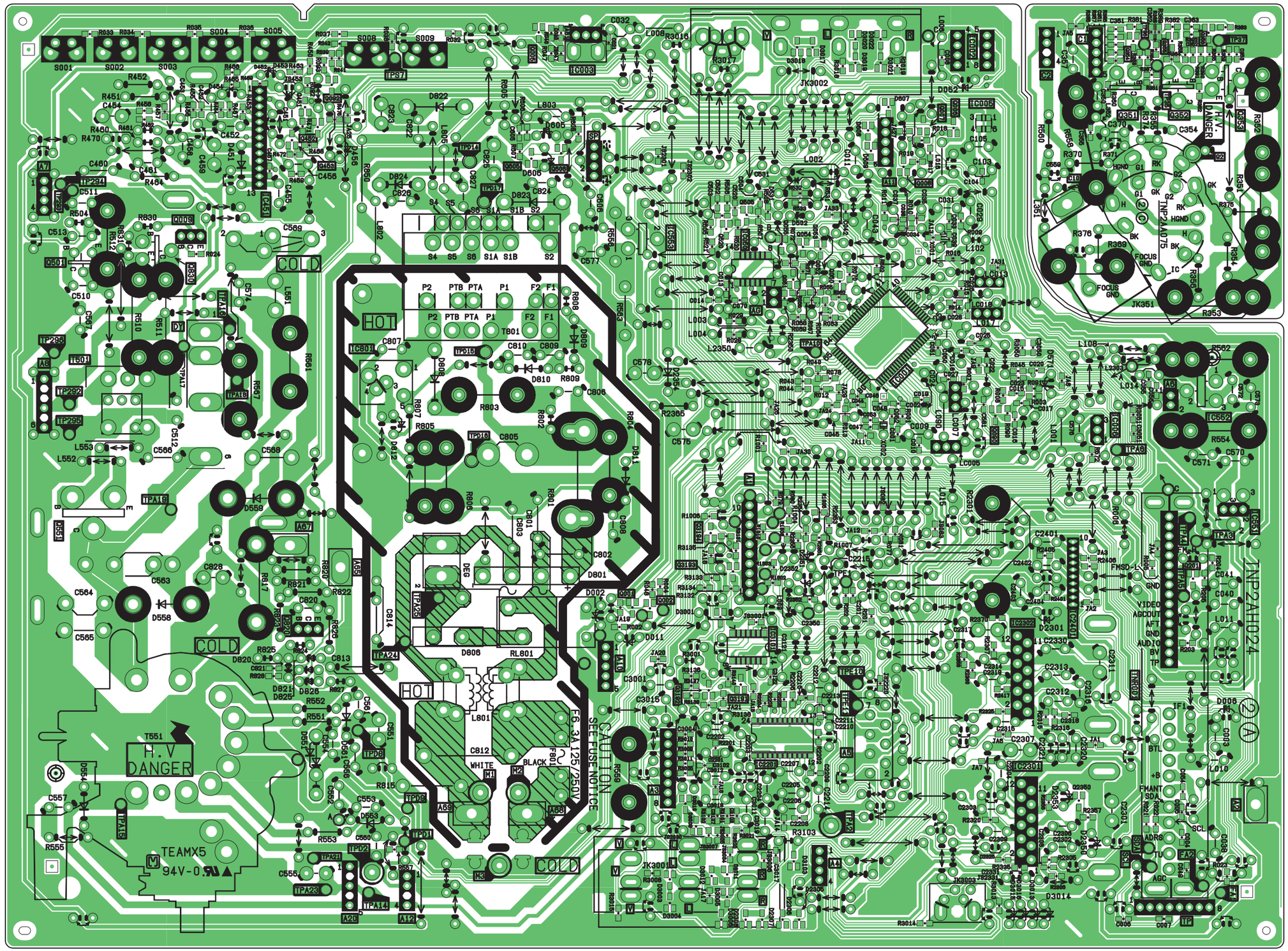
LOS DIAGRAMAS ELÉCTRICOS INCLUYEN CARACTERÍSTICAS ESPECIALES MUY IMPORTANTES PARA LA PROTECCIÓN CONTRA RAYOS-X, QUEMADURAS Y DESCARGAS ELÉCTRICAS. CUANDO SE DE SERVICIO ES IMPORTANTE USAR PARA REEMPLAZO DE COMPONENTES CRITICOS, SOLO PARTES ESPECIFICADAS POR EL FABRICANTES. LOS COMPONENTES CRITICOS ESTAN SEÑALADOS EN LOS DIAGRAMAS POR EL SIMBOLO ⚠.

IMPORTANT SAFETY NOTICE

THIS SCHEMATIC DIAGRAM INCORPORATES SPECIAL FEATURES THAT ARE IMPORTANT FOR PROTECTION FROM X-RADIATION, FIRE AND ELECTRICAL SHOCK HAZARDS. WHEN SERVICING IT IS ESSENTIAL THAT ONLY MANUFACTURERS SPECIFIED PARTS BE USED FOR THE CRITICAL COMPONENTS DESIGNATED WITH A ⚠ IN THE SCHEMATIC.

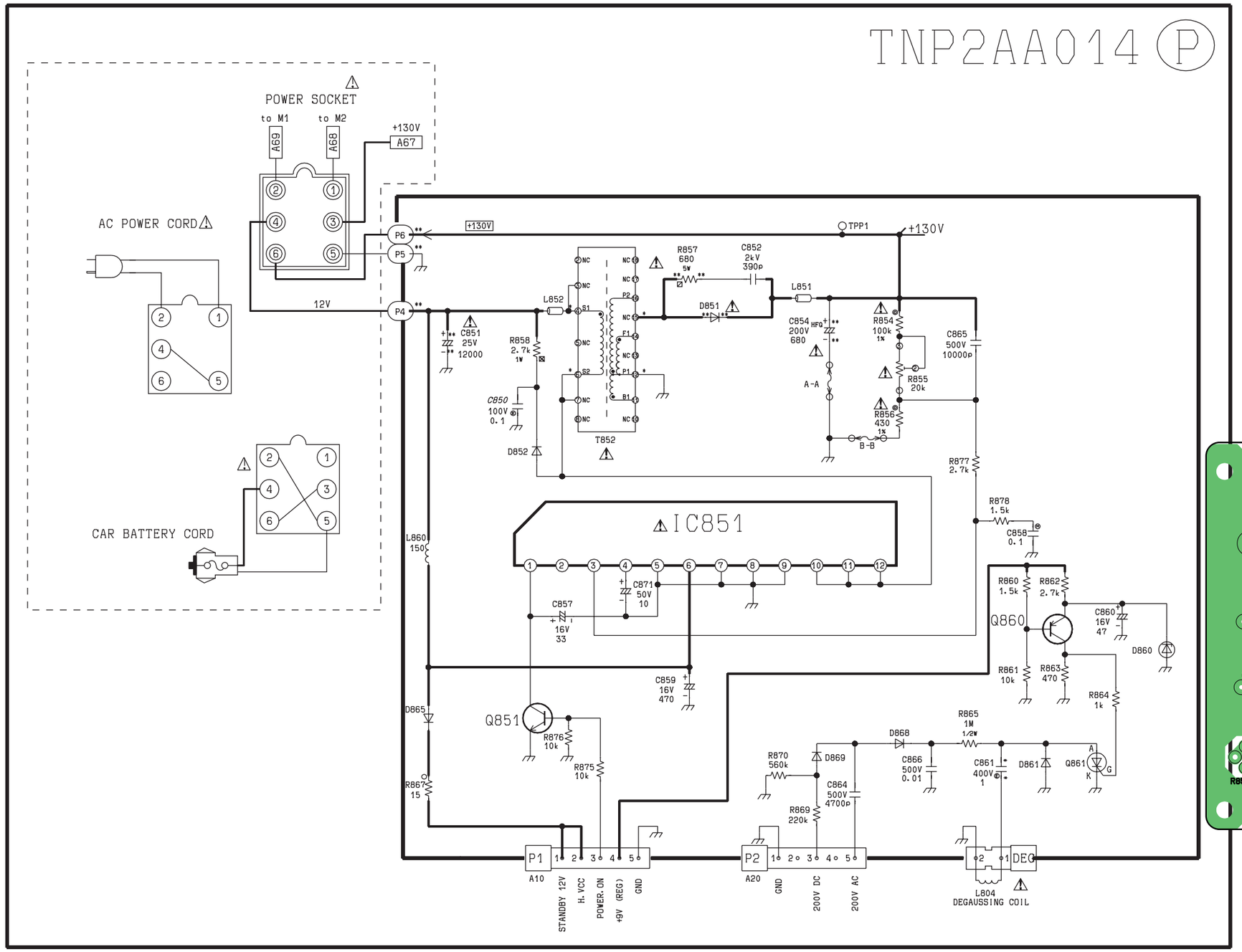
A & C-BOARDS -- TARJETAS A Y C
ALL MODELS - TODOS LOS MODELOS

A & C-BOARDS LAYOUT -- CIRCUITO IMPRESO DE LAS TARJETAS A Y C



P-BOARD SCHEMATIC, LAYOUT & VOLTAGES
DIAGRAMA ELÉCTRICO, CIRCUITO IMPRESO Y VOLTAJES TARJETA P

P-BOARD - TARJETA P
CT-13R52DE

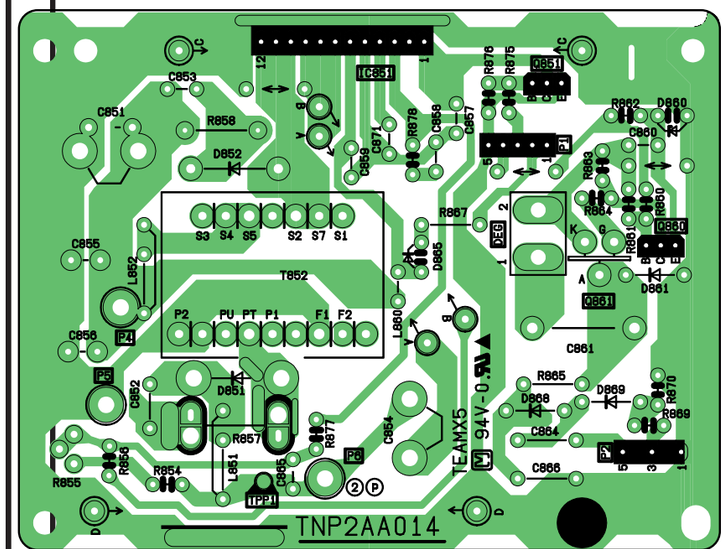


Receiver is in AC-Mode
Receptor en la modalidad AC

IC851	
1	0.00
2	n.c
3	0.00
4	0.00
5	GND
6	0.00
7	GND
8	GND
9	GND
10	0.00
11	0.00
12	0.00

	Q851	Q860
B	0.00	7.94
C	0.00	0.00
E	GND	6.18

	Q861
K	GND
A	180.00
G	GND



NOTES -- NOTAS

SERVICE MODE (ELECTRONIC CONTROL)
SERVICE ADJUSTMENT VALUES

Model _____ Ser #_____ Date_____

Note: Record the original settings PRIOR to modifying the registers.

Mode	Service Adjustment	Adjustment Range	Def. Val.	Original Value	New Value
Sub Adjustments					
B0	SUB-COLOR	0 ~ 127	33		
B1	SUB-TINT	0 ~ 127	36		
B2	SUB-BRIGHTNESS	0 ~ 255	127		
B3	SUB-CONTRAST	0 ~ 127	20		
B4	R OFFSET	N/A	0	FACTORY PRESET	
B5	YNR	N/A	0	FACTORY PRESET	
B6	YNR LIM	N/A	0	FACTORY PRESET	
Cut-Off Adjustments					
C0	CUT-OFF R	0 ~ 255 0 ~ 255	0 255		
C1	CUT-OFF G	0 ~ 255 0 ~ 255	0 255		
C2	CUT-OFF B	0 ~ 255 0 ~ 255	0 255		
C3	R DRIVE	0 ~ 127	80		
C4	G DRIVE	0 ~ 127	80		
C5	B DRIVE	0 ~ 127	80		
C6	V SIZE	0 ~ 255	127		
C7	NOT USED	--	--	NOT USED	
C8	NOT USED	--	--	NOT USED	
C9	HORIZONTAL CENTER	0 ~ 31	16		
CA	ACL	0 ~ 1	1		
CB	HHS	0 ~ 7	0		
CC	OSD SHIFT	N/A	88	FACTORY PRESET	
CD	ACL-REF	N/A	74	FACTORY PRESET	
CE	ACL-REF	N/A	64	FACTORY PRESET	
CF	ACL-REF	N/A	48	FACTORY PRESET	
C10	ACL-REF	N/A	40	FACTORY PRESET	
C11	ACL-REF	N/A	31	FACTORY PRESET	
C12	ACL-REF	N/A	20	FACTORY PRESET	
C13	ACL-COEFF	N/A	124	FACTORY PRESET	

Mode	Service Adjustment	Adjustment Range	Def. Val.	Original Value	New Value
Cut-Off Adjustments, Cont.					
C14	ACL-COEFF	N/A	117	FACTORY PRESET	
C15	ACL-COEFF	N/A	94	FACTORY PRESET	
C16	ACL-COEFF	N/A	80	FACTORY PRESET	
C17	ACL-WAIT	N/A	2	FACTORY PRESET	
C18	ACL-THRESHOLD	N/A	9	FACTORY PRESET	
C19	MACROVISION	N/A	3	FACTORY PRESET	
C1A	OSD SELECT	N/A	1	FACTORY PRESET	
C1B	KILLER ON	N/A	6	FACTORY PRESET	
C1C	KILLER OFF	N/A	20	FACTORY PRESET	
C1D	KILLER TIME	N/A	3	FACTORY PRESET	
C1E	ACC THRESHOLD	N/A	17	FACTORY PRESET	
C1F	ACC OFF	N/A	7	FACTORY PRESET	
C20	MUTE TIME	N/A	11	FACTORY PRESET	
Options Adjustments					
S0	SHARPNESS PW	N/A	3	FACTORY PRESET	
S1	SHARPNESS OW	N/A	3	FACTORY PRESET	
S2	HALFTONE	N/A	0	FACTORY PRESET	
S3	TVC DELAY	N/A	0	FACTORY PRESET	
S4	TVY DELAY	N/A	0	FACTORY PRESET	
S5	GAMMA	N/A	13	FACTORY PRESET	
S6	VIDEO Y DELAY	N/A	0	FACTORY PRESET	
S7	VIDEO C DELAY	N/A	0	FACTORY PRESET	
S8	COMB BPF	N/A	0	FACTORY PRESET	
S9	COMB 2D	N/A	1	FACTORY PRESET	
SA	COLOR KILLER LEVEL	N/A	0	FACTORY PRESET	
SB	KILLER THRESHOLD	N/A	0	FACTORY PRESET	
SC	ACC SW	N/A	0	FACTORY PRESET	
SD	ACC AMP OFF1	N/A	100	FACTORY PRESET	
SE	ACC AMP OFF2	N/A	0	FACTORY PRESET	
SF	ACC AMP ON	N/A	20	FACTORY PRESET	

SERVICE MODE, CONT. (ELECTRONIC CONTROL)
SERVICE ADJUSTMENT VALUES

Model _____ Ser #_____ Date_____

Note: Record the original settings PRIOR to modifying the registers.

Mode	Service Adjustment	Adjustment Range	Def. Val.	Original Value	New Value
Options Adjustments (Cont.)					
S10	ACC AMP CTL	N/A	3	FACTORY PRESET	
S11	BGP POSITION	N/A	21	FACTORY PRESET	
S12	OSD R	N/A	30	FACTORY PRESET	
S13	OSD G	N/A	30	FACTORY PRESET	
S14	OSD B	N/A	30	FACTORY PRESET	
S15	NOISE KILLER TIME	N/A	5	FACTORY PRESET	
S16	NOISE KILLER (ACC)	N/A	50	FACTORY PRESET	
S17	HV TIMING	N/A	2	FACTORY PRESET	
VCJ Adjustments (Black Expansion)					
P0	FORCE BS	N/A	1	FACTORY PRESET	
P1	DET ON/OFF	N/A	1	FACTORY PRESET	
P2	ROM SEL	N/A	3	FACTORY PRESET	
P3	ROM CURVE	N/A	2	FACTORY PRESET	
P4	BS ON/OFF	N/A	1	FACTORY PRESET	
P5	BS TIME CONSTNAT	N/A	5	FACTORY PRESET	
P6	THRESHOLD V	N/A	4	FACTORY PRESET	
P7	THRESHOLD F1	N/A	129	FACTORY PRESET	
P8	THRESHOLD F1	N/A	1	FACTORY PRESET	
P9	THRESHOLD OFF1 (EFFECT OFF)	N/A	35	FACTORY PRESET	
PA	THRESHOLD F2	N/A	99	FACTORY PRESET	
PB	THRESHOLD F2	N/A	1	FACTORY PRESET	
PC	THRESHOLD OFF2 (EFFECT OFF)	N/A	30	FACTORY PRESET	

Mode	Service Adjustment	Adjustment Range	Def. Val.	Original Value	New Value
VCJ Adjustments, Cont. (Black Expansion)					
PD	THRESHOLD F3	N/A	80	FACTORY PRESET	
PE	THRESHOLD F3	N/A	1	FACTORY PRESET	
PF	THRESHOLD OFF3 (EFFECT OFF)	N/A	21	FACTORY PRESET	
P10	THRESHOLD ON1	N/A	37	FACTORY PRESET	
P11	THRESHOLD ON2	N/A	33	FACTORY PRESET	
P12	THRESHOLD ON3	N/A	25	FACTORY PRESET	
P13	CURVE1	N/A	3	FACTORY PRESET	
P14	CURVE2	N/A	3	FACTORY PRESET	
P15	CURVE3	N/A	3	FACTORY PRESET	
P16	RATIO1	N/A	0	FACTORY PRESET	
P17	RATIO2	N/A	2	FACTORY PRESET	
P18	RATIO3	N/A	3	FACTORY PRESET	
Other Adjustments (With FM)					
X0	AFCT	0 ~ 127	83		
X1	AFCB	0 ~ 127	44		
X2	AFCC	0 ~ 127	64		
X3	CLOCK	0 ~ 255	128		
Other Adjustments (Without FM)					
X0	AFCT	0 ~ 127	60		
X1	AFCB	0 ~ 127	29		
X2	AFCC	0 ~ 127	42		
X3	CLOCK	0 ~ 255	128		

Note: *Some adjustments modes may not be available on all models, depending on applicability.*

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